

*Your Victory Home*



# POPULAR MECHANICS MAGAZINE

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**SEE PAGE 1**





## Remember when ... *you could buy new tires whenever you pleased?*

**I**T DIDN'T MATTER so very much then if a tire's pressure was a little lower than it should have been.

We didn't worry a great deal if we stopped shorter than we should, and left a few rubber marks on the pavement.

There was nothing terribly wrong about gouging off a little of the tread in showing how fast we could get away from a stop-light.

And, as long as we chose the right time and place, it was no crime to "burn up the road" occasionally for the sheer joy of fast motion.

It's different now—and how!

Every car in use today is a national asset; it must be kept rolling. And every ounce of rubber in its tires is part of our wartime resources—to be cared for, protected against abuse, made to last as long as possible.

That's the reason for frequent tire inspections

—Victory Speed—slow starts and stops—properly maintained tire pressures—careful parking to avoid sidewall damage—and all the other tire-saving precautions you can take.

By doing these vitally important things—not just *some* of them but *all* of them—every American car owner can help in a very real way to make victory more certain and more complete.

\* \* \*

REMEMBER WHEN your Seiberling Dealer was able to offer you all the brand new tires you wanted? He can't be liberal with tires today, but he can and does come through with the personal service and personal interest you can get only from an INDEPENDENT business man. We at Seiberling believe in the dynamic, creative force of American independence—independence of thought and action, and INDEPENDENCE IN BUSINESS. That is why Seiberling Tires will continue to be sold, as they have been for a generation past, by INDEPENDENT dealers only.

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Wartime manufacturers of Bullet-Sealed Tubes and Military Tires for our armed forces • Bullet-Sealing Gasoline Tanks • Rubber Floats, Boats and Pontons • Rubber Parts for Gas Masks, Airplanes and Tanks. Also makers of Tires and Tubes for passenger cars and trucks • Sealed Air Tubes • Rubber Heels, Soles and Mechanical Goods.



"SWEETHEART," HE SAID SOFTLY, "THEY  
COULDN'T KILL A GAL LIKE YOU..." He touched  
 the tank tender-like. Nazi shells had ripped into  
 her heart... You'd think she would have died with two-  
 fifths of her engine knocked out...but she didn't!...  
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NOW, the heart of that General Sherman tank was not one engine...but  
 five, hooked together...and all five are the same six-cylinder jobs you have in your  
 Chrysler. These engines can run on their sides...on their backs. And even when two are  
 destroyed by enemy fire, the other three can keep the tank rolling. You can credit  
 Chrysler Division "know-how"...and an alert U. S. Ordnance Department for this one.

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# THE SEARCH THAT NEVER ENDS



**I**N THE industrial life of America, research has been of constantly increasing importance. And today it is a national resource, for the research of industrial and college laboratories is proving its value in War.

To the Bell System, research is an old idea, for the telephone itself was born in a laboratory. Behind its invention, sixty-nine years ago, were researches in electricity and acoustics and in speech and hearing.

And, ever since, there has been a laboratory where scientists have searched to know more about these subjects; and with their associated engineers have applied the new knowledge, fitting it with all the old, to make the telephone better and better.

Their fields of inquiry have broadened and deepened through these years; they inquire into all the sciences and engineering arts which have any promise of improving the telephone. Much has been learned but still more will be, because their search goes on. That is why the telephone laboratory grew to be Bell Telephone Laboratories, Incorporated, the largest industrial

laboratory in the world. And it exists to improve telephone service.

Improvements in industry can be left to chance in the hope that some one, sometime, will think of something useful; that some good invention will turn up.

The other way to make improvements is to organize so that new knowledge shall always be coming from researches in the fundamental sciences and engineering arts on which the business is based. From that steady stream will arise inventions, new methods, and improved products.

This is the way of Bell Laboratories. Its search will never end. And as fast as it can the Laboratories will apply its new knowledge practically to the design of equipment and communication systems.

At present—and this started before Pearl Harbor—its trained scientists and engineers and all their skilled associates are concentrating on products of importance to our armed forces. But when this work is happily over they will be ready to continue their developments for the needs of peace.



**BELL TELEPHONE SYSTEM**

*"Research is an effort of the mind to comprehend relationships no one has previously known; and it is practical as well as theoretical." . . . BELL TELEPHONE LABORATORIES*



# Popular Mechanics Magazine

Registered in U. S. Patent Office and Canada

H. H. WINDSOR, Founder

H. H. WINDSOR, Jr., Editor and Publisher

February, 1944

Vol. 81, No. 2

## Next Month

**T**AKE a commando, sprinkle him with salt water, and add the tenacity of a bulldog. The result is something akin to what is known in the Navy and Army as an "amphib." This new kind of fighting man strikes with the swiftness of a commando and hangs on like a bulldog to a piece of enemy shore. His important job is to land men, guns, tanks and supplies right under the enemy's nose. "Amphibs" man an assortment of vessels that range from motorboat size to huge barges that roll up on a beach like stranded whales. How these amphibious commandos work is told in a March story "Getting 'Em Ashore."

## Wonder Liquid

**I**N peacetime you rubbed it in your hair, chewed it, smoked it, ate it, and drank it in beverages to the tune of about 150 million pounds a year. But since Pearl Harbor, this wonder liquid has been producing high explosives, quick-drying paints for tanks and planes, fluid for the hydraulic mechanisms of big guns, and scores of other strategic items. A March article tells why glycerin is the "Liquid of a Thousand Uses."

## Timber Panzers

**F**OR every man in uniform, five trees have gone to war. The "recruiting" job being performed in the woods to meet wartime demands has made the old style logger as out of date as an ox-team. Felling a giant Douglas fir used to take from 12 to 20 hours. Today mechanized equipment does the job in an hour. Meet the "Wooden Soldiers of 1944" next month.

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## The Flying Cannoneers

**S**OMEWHERE in the Pacific the nose of a Douglas A-20 is pointed down at a nervous Jap destroyer and the pilot's thumb presses the button marked "Guns." A rumble of cannon fire drowns the roar of the engine as Uncle Sam's flying artillery goes into action. German Tiger tanks, submarines, and locomotives have also felt the sting of cannon with wings. One of the flashiest attack planes is the P-51 Mustang with a row of four 20-mm. guns studding the leading edge of its wing. An article next month takes you behind the scenes with the aerial artillery on many fronts.

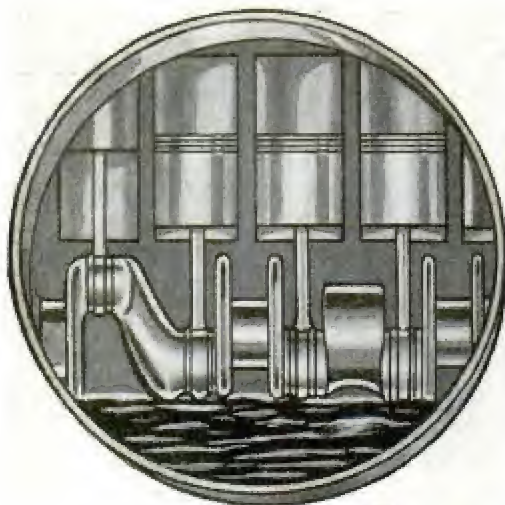
## "Stop-and-Go Lights" of the Air

**A**MERICA will have 20 million air passengers by 1950 who will be riding in some 500,000 aircraft, according to William A. M. Burden, special aviation assistant to the Secretary of Commerce. In a March article, Mr. Burden reveals some of the carefully laid plans for controlling future air traffic. Electronic devices, he says, will help make air travel safe. One is an ingenious anti-collision instrument that will show the position of a plane 10 miles away.

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# ... don't shorten the life of your car with extra wearing cold weather "dry starts"

If you want to stop wear of your cylinders and piston rings, you must be sure that metal doesn't rub metal. In cold weather—when you use winter oil (low viscosity oil) this happens frequently. When you stop your motor this low viscosity oil quickly drains off the hot cylinder walls. After some hours the cylinder walls are cold and nearly dry of oil. They are then not only subject to rust—but also to scoring and wear when metal rubs metal as you start your car.

Pyroll stops this! It maintains a constant oil film over the cylinder walls. It insures thoroughly lubricated piston rings. It prevents rust and corrosion and "gumming." Your car starts quicker—you stop excessive wear. Simply put 1 pt. of Pyroll in the crank case, and add one ounce to each 5 gallons of gasoline.

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Where no name and address appear directly under an item, the product is not believed by us to be commercially available

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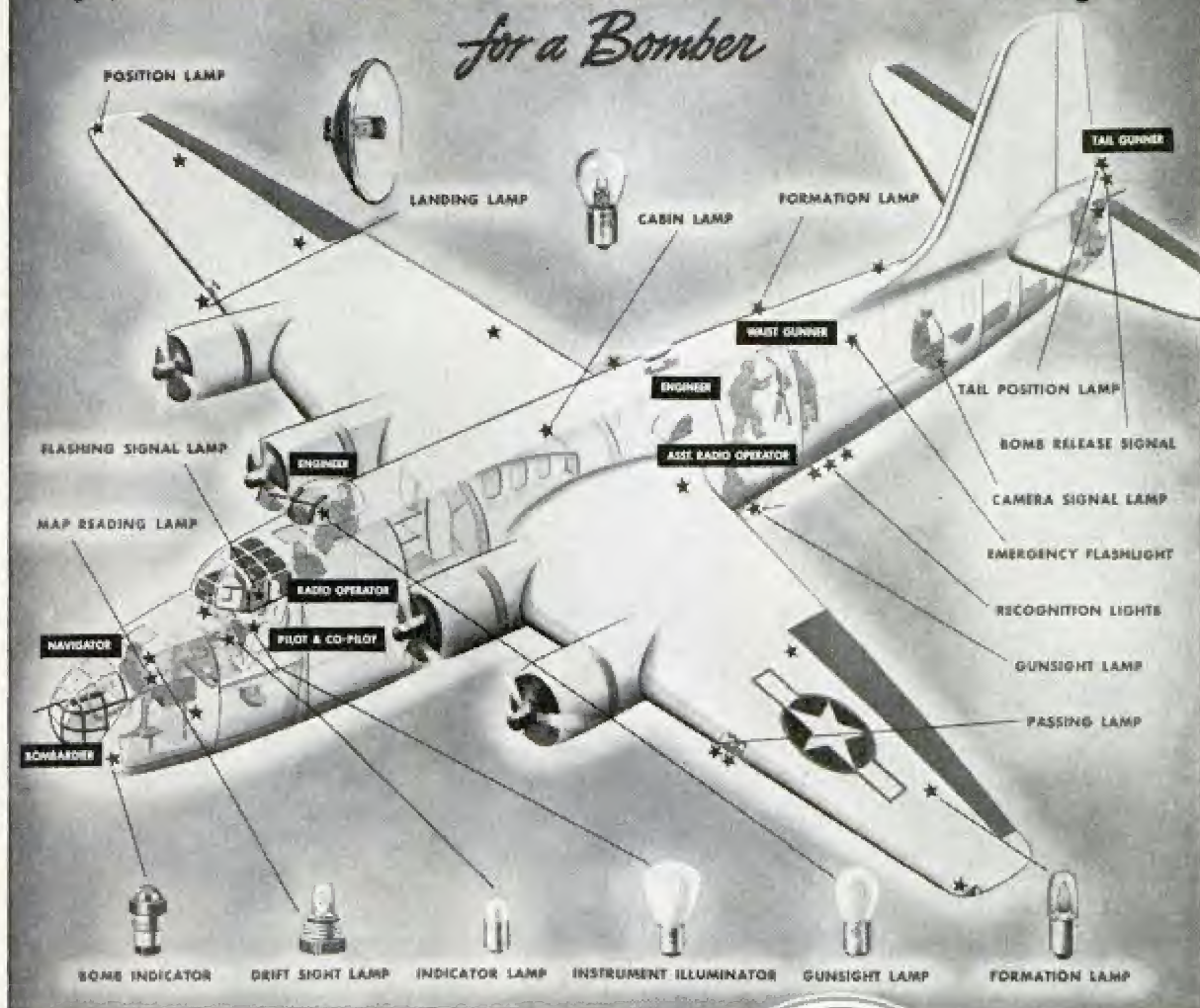
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# Here's the inside on General Electric Lamps for a Bomber



**W**HEN a 4-motor bomber takes off, these are some of the 200 special G-E lamps that serve its crew—help them do their job.

Specially developed for war use, they're only part of the hundreds of different lamps that General Electric makes to meet military and war production needs. But each benefits from the research and manufacturing precision that make your General Electric lamps at home so efficient and dependable. They're all *made to stay brighter longer!*

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**GENERAL  ELECTRIC**



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WAR BONDS—  
FOR VICTORY**



**This One**

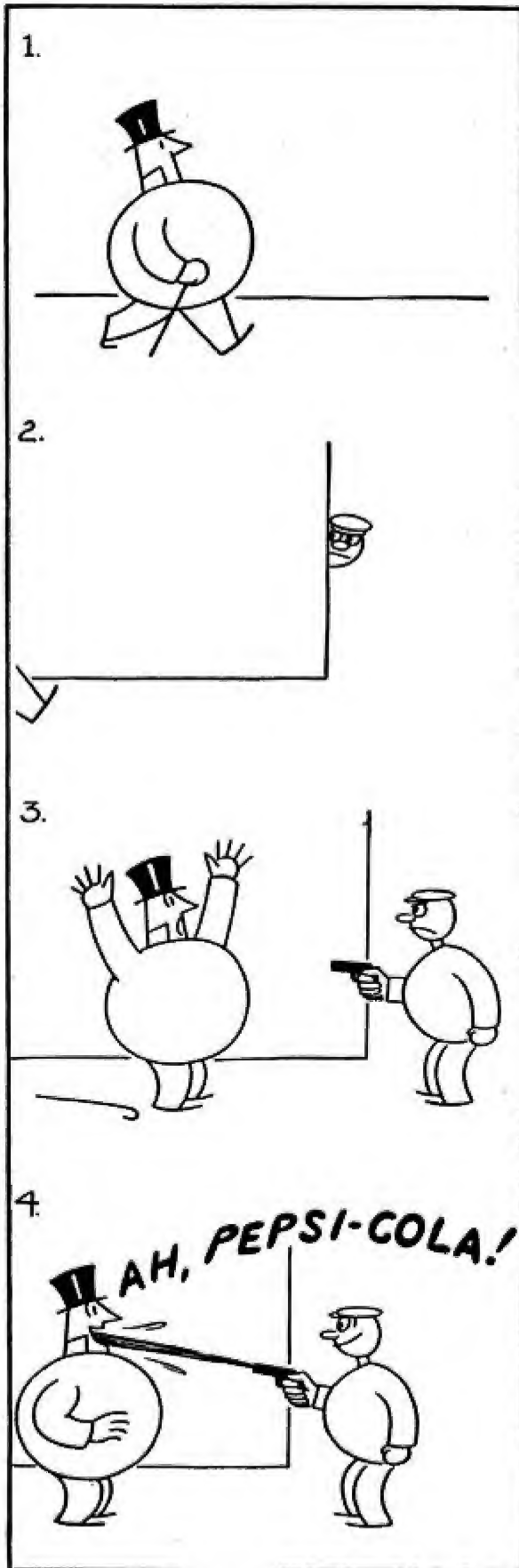


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#### IMPORTANT NOTICE

It is the intention of this magazine to provide its readers with information regarding the latest developments in the mechanical arts. We take no responsibility as to whether the disclosures contained in our articles are covered by patents and advise readers to investigate this subject before making, using, or selling any of the products, machines, or processes described in order to avoid possible liability for patent infringement.



**Y**ES, Mr. (or Miss) Bookkeeper, you can become an accountant and make real money.

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SWEET LAND OF LIBERTY



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*\*F. A. S., Indiana*



**Plays from Start**

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*\*F. R. O., Illinois*

*\*Actual names on request.  
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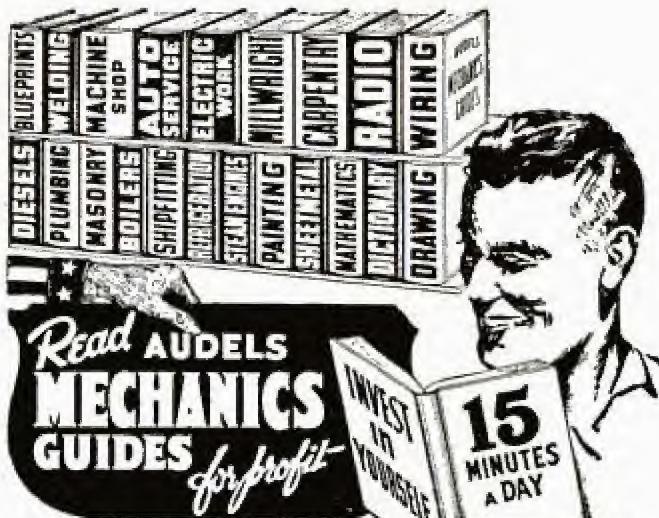
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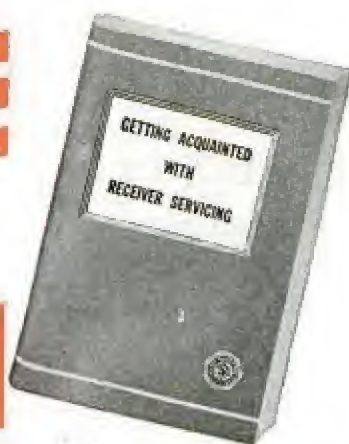
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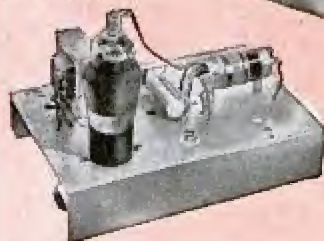
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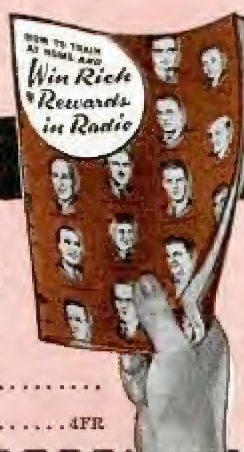


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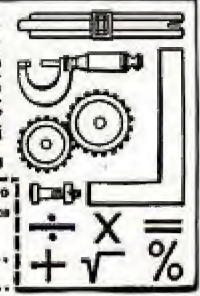
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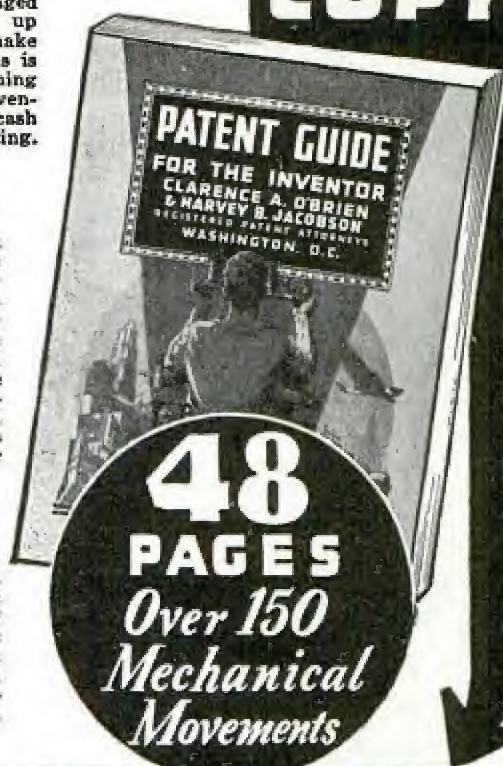
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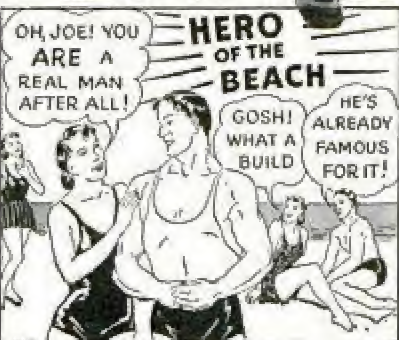
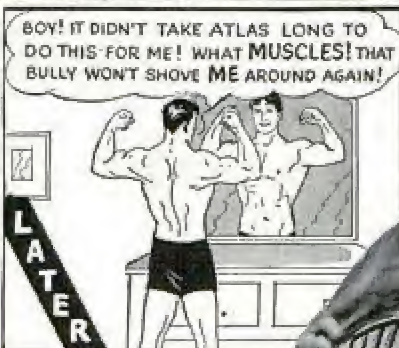
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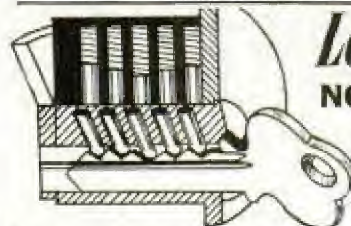
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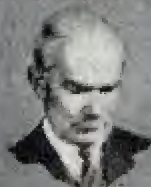
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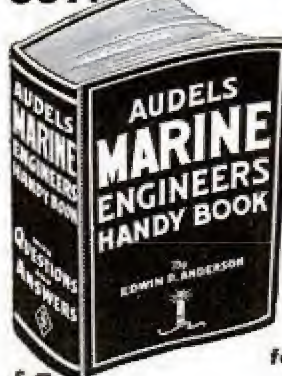
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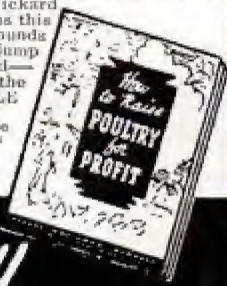
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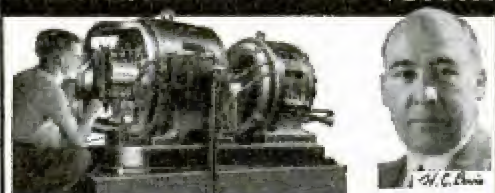
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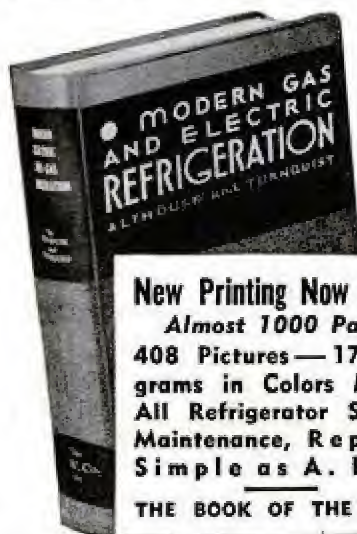
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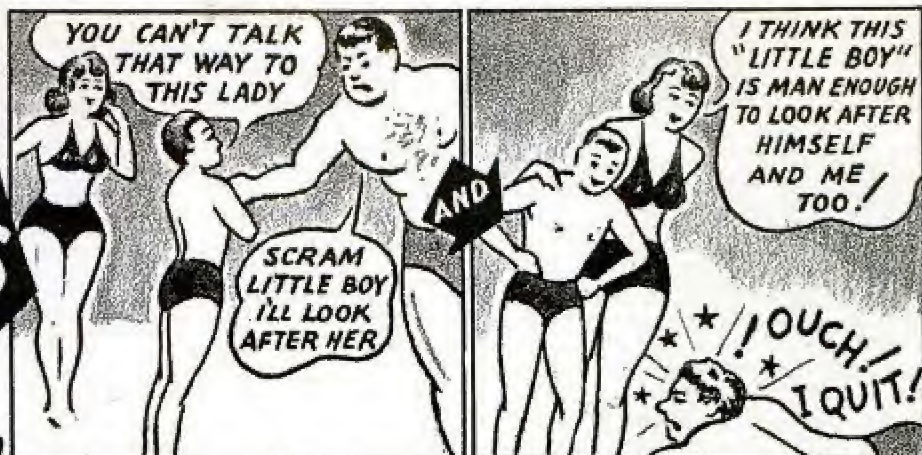
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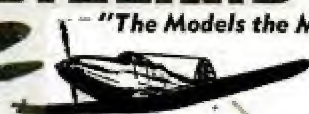
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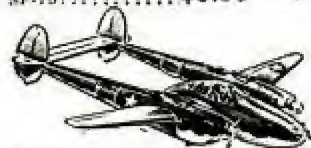
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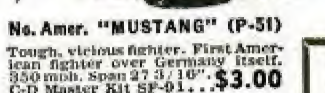
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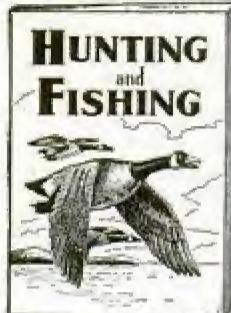
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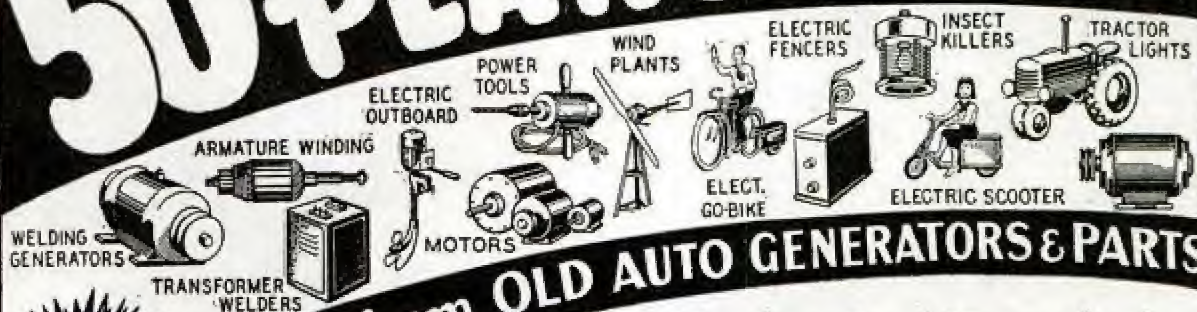
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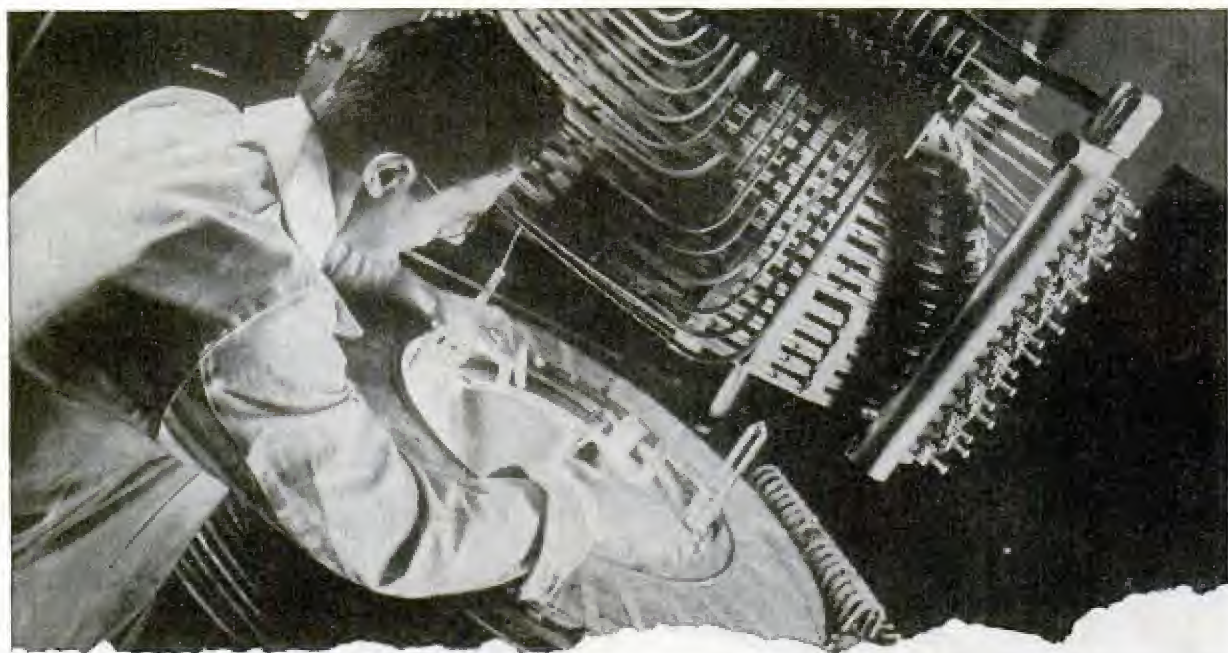
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Helping the tire maker: Pictured here is a laboratory model of the new Westinghouse-developed "mass spectrometer," an adaptation of which analyzes gases with incredible swiftness and accuracy. Right now, one of the most important of its many uses is speeding up tremendously a step in the making of synthetic rubber.

## Westinghouse research accepts every wartime challenge . . .

Under the spur of war, Westinghouse research is delving into numberless mysteries, not only in the vast field of electricity and electronics, but also in chemistry, physics, metallurgy, plastics. And as a result, out of the great Westinghouse laboratories has come a steady stream of new war products, and new and better ways of making old ones.

## Westinghouse research develops new talent for America . . .

To Westinghouse, each year, come several hundred budding scientists and engineers—to work, to learn, to blaze new trails in electrical research. And each year, through more than 100 Westinghouse scholarships, young men enter America's engineering colleges to develop the native skill and talent that have made America great and will make it greater.



## Westinghouse research promises new wonders for peace . . .

You have heard much talk of the marvels science will offer you after the War. Well, there *will* be marvels—plenty of them—and Westinghouse research is working to contribute its full share. But we will never lose sight of what we consider our first duty: seeing that, beyond all question, each Westinghouse product, old or new, is the very finest of its kind. Westinghouse Electric & Manufacturing Co., Pittsburgh, Penna. Plants in 25 cities, offices everywhere.



# Popular Mechanics Magazine

REGISTERED IN U. S. PATENT OFFICE AND CANADA

WRITTEN SO YOU CAN UNDERSTAND IT

Vol. 81

FEBRUARY, 1944

No. 2

71 748



Striking a point where a trestle is out, the auto-railer freight retracts its steel wheels and takes to the highway

By E. S. Evans

of Evans Products Co.  
Fullerton at Greenfield

TO THE young man of yesterday it seemed that the words of Horace Greeley, "Go west, young man," no longer had the inspiration and thrill they once possessed. No longer were there frontiers to be crossed and new discoveries to be made where fortunes could be acquired through adventure and daring. The horizons had closed down. No longer were there gold rushes or homesteading. No longer were territories being opened up for new settlers, and men had to find their fortunes at home in the hard way.

Now a thrilling development in transportation once more opens the door to wonderful new adventure. New lands rich in natural resources, holding out attractions for industrialists, agriculturists, miners, and in fact, every walk of life, can be brought within range of modern energies.

Col. Edward S. Evans, president of the Evans Products Co., supervised freight loading for the Quartermaster Corps in World War I, has since become one of our leading inventors and manufacturers of automotive, rail and aviation equipment. Here he presents his unique proposal for an auto-railway to Alaska

Let me draw you a picture. We are driving down a highway paralleling a railroad. Swiftly, silently, on the railroad there comes a Diesel-powered train with locomotive and 25 cars. Ahead there is a bad washout; the rail-

Detached 27. Mott.





With steel pilot wheels lowered, the pneumatic tires of the auto-rail freighter ride on the rails

drop into place and serve as pilot wheels. There has been little or no delay in this off-the-track, on-the-track movement.

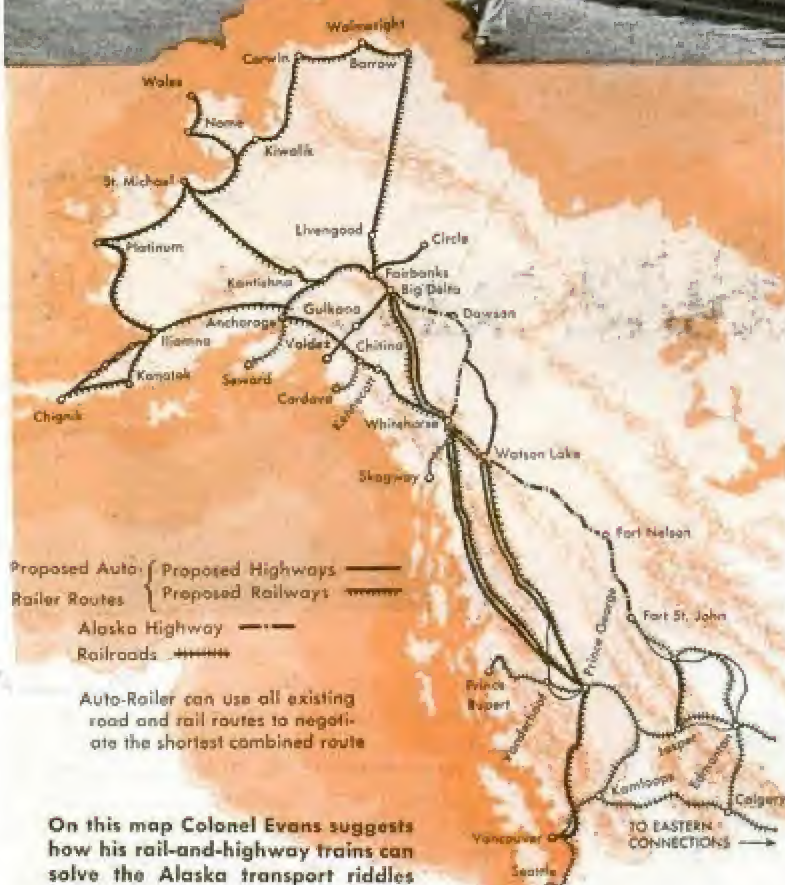
This is not a Buck Rogers dream. These dual road and rail vehicles are in daily use. They have operated millions of miles, on 18 railroads in the United States, Canada and Mexico hauling freight, mail, express, and passengers over steel track and highways.

Here in the marriage of the train and the truck is a new "iron horse" to open up new frontiers.

Alaska is rich not only in coal, but also oil, nickel, tin, asbestos and various other minerals including copper and gold, and has tremendous resources in furs, fisheries,

agriculture and timber. If we can open up this frontier, American youth and American enterprise once more will find wealth in payment for the requisite energies expended.

Alaska is one of the most difficult parts of the world to get into by land. There is no railroad in Alaska with road connections to Canada or the United States. The



road trestle shows a gap of 100 yards. A signal man stops the train at a highway crossing and, without an instant's delay, the train rolls off the track onto the parallel highway, up to the next crossing, beyond the washout, and back on the tracks.

This train is startling. The wheels are rubber-tired; and it has steel retractable flange wheels which, when on the track,



new Alaskan highway built by the Army is at best a semi-pioneer road. This is a rough trail through wilderness with temporary bridges susceptible to two-way traffic only in part, usable when frozen but precarious when thawing. Alaska is a land shut off from the world except by air and sea. Yet it has greater possibilities for development than any part of the Western World.

Billy Mitchell said in 1935: "Alaska is the most central place in the world



Here the rail train of the opposite page leaves the rails for the highway

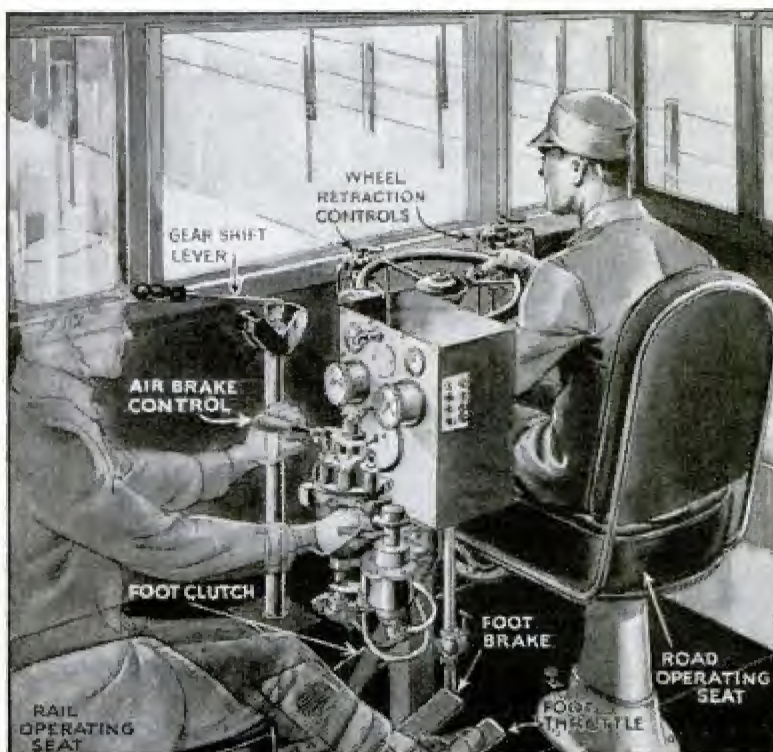


for aircraft and whoever holds Alaska in the future will hold the world. I think it is the most important strategic place in the world."

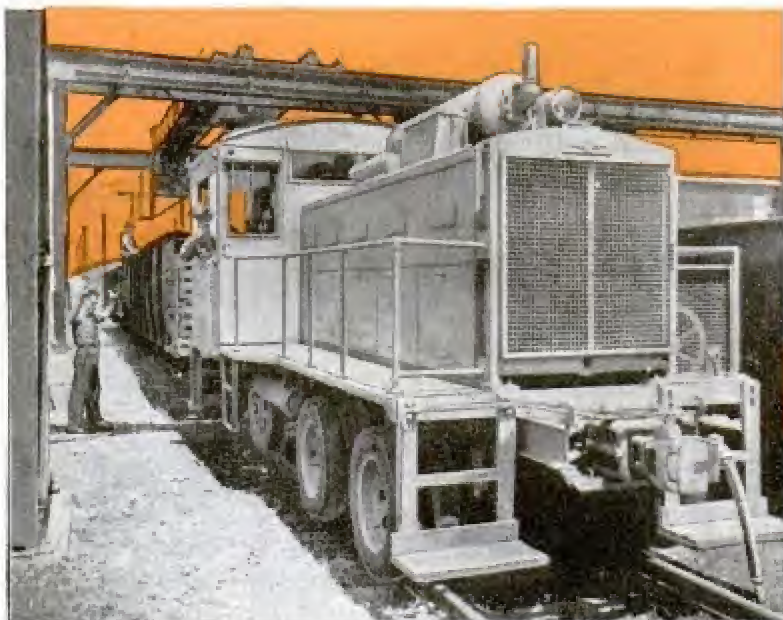
That this is true from a military standpoint there is no argument. It is also equally true from the standpoint of world industry. If you will take your map, you will see that Alaska is much nearer Europe and Asia, particularly the latter, than are Chicago and New York. Here are some of the comparative distances by air: Chicago to Berlin, 4,500 miles; Chicago to Moscow, 4,500 miles; Chicago to Tokyo, 4,800 miles; Fairbanks to Berlin, 4,400 miles; Fairbanks to Tokyo, 3,500 miles; Fairbanks to Moscow, 4,300 miles.

We have before us a

Above, the "floating" railway over the muskeg. Below, its dual controls







Auto-rail cars in several forms are already in service. Two of them are shown on this page, the pictures revealing clearly how tires ride on steel

world destroyed by war—a world that has to be rebuilt and supplied with everything used by the human race. Alaska can be the “corner general store” for these needy nations. It is the nearest shopping place for American goods and there is room in it for 7 million people instead of the 80,000 normally living there. There is also room in it for billions of dollars invested in industry, commerce, mining. It is the doorway to Russia. And one of these days we will probably see highways and railroads running from Alaska to the center of Siberia and Russia, ferrying across the Bering Straits in summer and by ice tractor in winter.

Great wealth and opportunity are locked within the iron boundaries of this unexplored land. Now, for the first time, there is a key that can unlock the door of Alaska. That key is the auto-railer.

The difficulties of building steam railroads into Alaska in the past have been almost insurmountable. It is a country of deep rivers, great mountain ranges and muskeg. Railroad men have conquered rivers and mountains, but muskeg offers an almost insuperable obstacle. Muskeg is a peat-like swamp with a bottom of ice. The ice recedes in summer and reaches the surface in winter. It is too hard to drive a pile. And even if the pile was driven and rested on the ice in the summer time, in

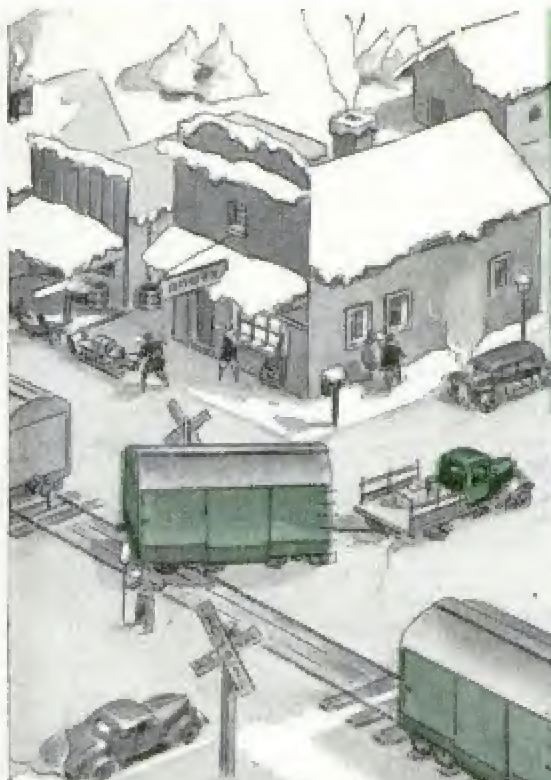


another warm summer the pile might sink out of sight.

Our big freight locomotives weigh as much as 300,000 pounds and our loaded freight cars weigh 50,000 pounds or more, each, and the steel tracks and ties with highly concentrated weights and vibration would sink into the quagmire of the muskeg. To avoid the muskeg country for the building of a road would require a long, circuitous route through mountain areas.

Never before has an Alaskan railroad been considered practical. But now the rubber-tired, light-weight, resilient auto-railer train makes railroads possible through undeveloped country. Auto-railers, which run with equal facility on rails



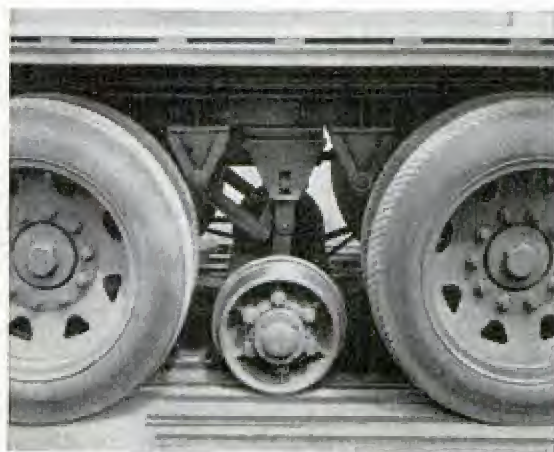


The auto-railer above mounts a snow plow which could function on railroad or highway. At left, a string of the lightweight freight cars arrives in an Alaskan outpost and sets out a boxcar, which is hauled away to its consignee by a local trucker

and roads, will negotiate 30-degree curves and climb 10-degree grades; they are even more efficient than steam or Diesel-electric railroad equipment; they are about one-third as heavy and can be successfully operated on channel steel or wooden rails hewn from the local timber.

Now don't scoff at the idea of wooden tracks, as they are the first kind of tracks used by railroads in this country. They had

This closeup shows arrangement of the pilot truck



metal straps on top to support steel wheels, and there were only single rails. But with dual tires on auto-railers a double track can be used. As the auto-railer locomotive and all of the cars operate on rubber tires, there would be no wear to speak of on the wooden rails and tires and track would last indefinitely.

In the muskeg country a corduroy road made of 24-foot trees 12 inches in diameter can be laid on top of the muskeg, and the wooden rails laid on top of them. They would act like a pontoon bridge floating successfully under the lighter weights of the auto-railer trains—creating, in effect, a "floating" railroad. Relatively light wooden trestles can be quickly erected in rough terrain for inauguration of auto-railer train service; to bridge a river or stream, wooden railroad tracks can be laid on pontoons.

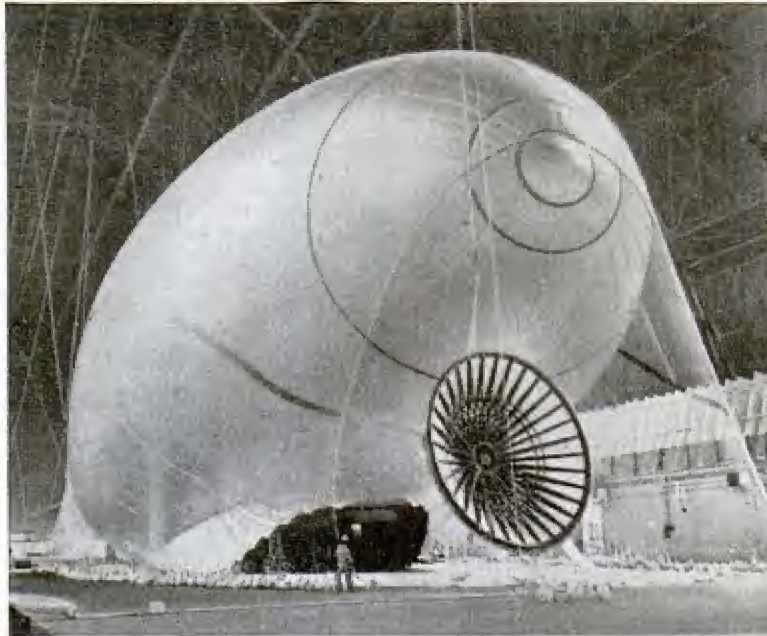
Whereas heavy trains cannot be operated

(Continued to page 160)



# Super-Blimp to Hunt Subs With Bigger Bombs

77 826



Packing far greater power to hunt down the wolf packs of submarines off American shores, a new super-blimp will soon join the fleet of "K" ships patrolling the Atlantic. Fifty percent larger and carrying that much more helium than the "K" blimps, the new "M" ship, built by Goodyear Aircraft Corporation, has a wider cruising range and will carry bigger bombs and more guns to counter the recently increased antiaircraft batteries of the subs. The super-blimp is faster than its predecessors.

Nose cone hangs like a giant parasol ready for placement

## "Mechanical Memory" Records Battle on Wire

All the sounds of battle are recorded with a device now being built at the Armour Research Foundation in Chicago for installation in Navy planes. The instrument, no larger than a portable typewriter, records the sounds on thin steel wire through a magnetic unit. The wire can be used for another recording after it is de-magnetized. This "mechanical memory" provides a complete record of a bombing mission, from conversations between pilot and crew to the firing of machine guns.

*Marvin Cantas*

Recorder is no larger than a portable typewriter. The recording is made on wire only .004 inch thick



## Helicopter "Air Bus of the Future" Is Proposed to Seat 14 Passengers



Shown as the "air bus of the future" by the Greyhound Corporation is a model of a 14-passenger helicopter, designed by Raymond Loewy in collaboration with Igor Sikorsky, the helicopter specialist. The model, which has a cigar-nosed, streamlined fuselage and a triangle landing gear, was shown recently at hearings before the Civil Aeronautics Board.



# Flying Boat Mars Stays Aloft 32 Hours in Test



The 22 men who stayed aloft in the 70-ton Martin Mars for flight that set a distance record pose (left) on sturdy craft. Below, in flight, with two propellers feathered, and resting on water



Baltimore, Md.

Records were shattered when the 70-ton Martin Mars, world's largest flying boat, breezed through a series of grueling tests to qualify for the Naval Air Transport Service. In a non-refueling endurance flight, the Mars traveled more than 4,600 miles and stayed in the air for 32 hours and 17 minutes. The distance was equivalent to a trip from Baltimore to Berlin and back to London. This exceeded the distance record for seaplanes by about 50 percent and broke three other official and seven unofficial records for both seaplanes and landplanes. The Mars, which was built by the Glenn L. Martin Company, carried a gross load of 141,000 pounds at the take-off. This included approximately a tank car load of fuel and 22 persons. In a test for structural strength, the Mars was taken up to an altitude of 13,000 feet and put into a power dive. Her giant wings withstood a load of 210 tons. In final flights before delivery to the Navy Trial Board, the big flying boat maintained altitude and then climbed with two of her four propellers fully feathered. Both engines were shut

off on the same side in the two-engine test—the most difficult operating condition for a four-motored craft. In presenting the Mars to the Navy, Glenn L. Martin, president of the aircraft company, reported that the ship could have stayed up several hours longer, but the crew was getting tired.

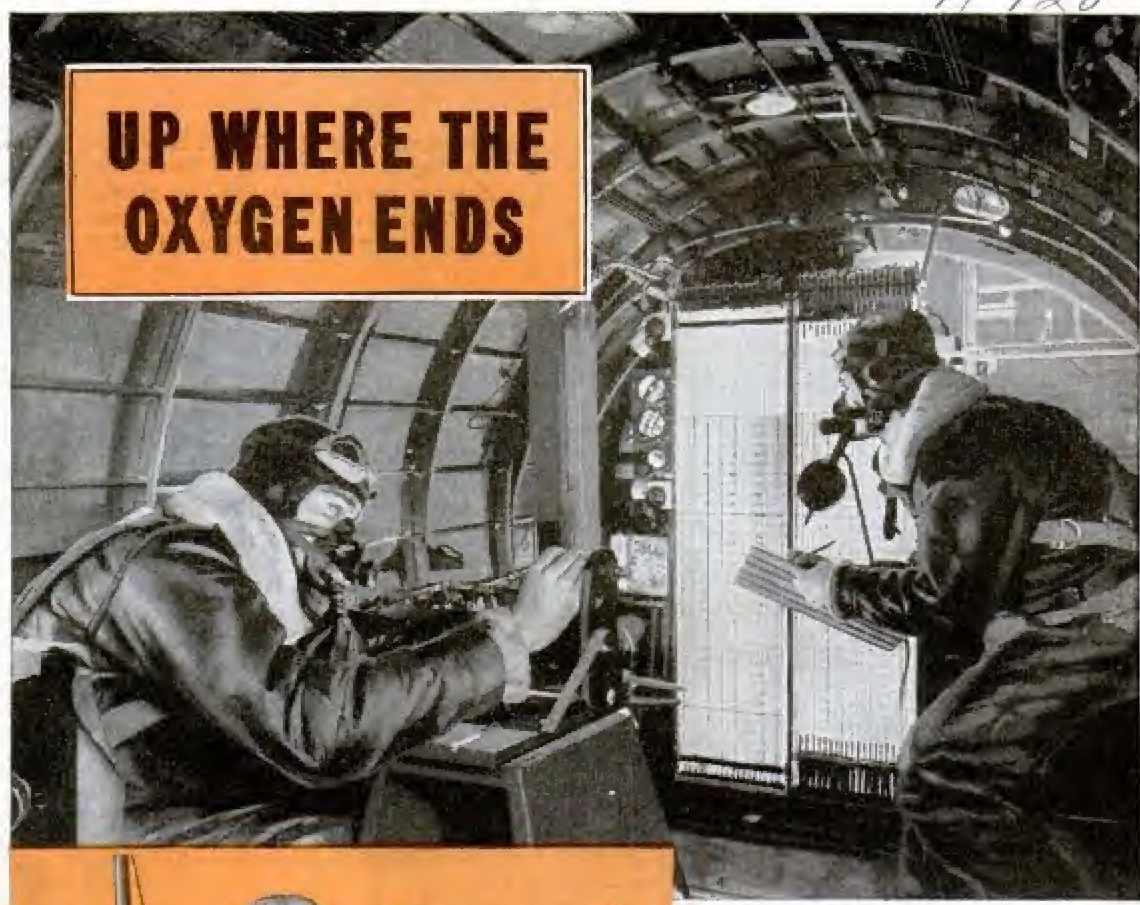
## U. S. Gun Fires 60,000 Feet Up

Enemy bombers will have to fly higher than 60,000 feet if they are to escape the fire of the U. S. Army's new 120-mm. anti-aircraft gun. The gun is said to be superior to our 90-mm. gun and far more effective than the German 88-mm. weapon. It can be used for anti-aircraft or for land targets.

71 854  
Maj. Gen. L. H. Campbell, Jr.  
Chief of Army Ordnance



# UP WHERE THE OXYGEN ENDS



Boeing engineers study instruments in a Flying Fortress used for high altitude tests. Below, fighter pilot with oxygen equipment and machine gun cartridges over shoulder is ready to go

By Wayne Whittaker

SOME day in the not so distant future you will be riding in a luxurious substratosphere liner, perhaps the Los Angeles-London Limited, eight or nine miles above the earth. The air outside will be so cold—anywhere from 40 to 80 degrees below zero—that a cubic foot of water would freeze solid in a few minutes. You would be dead at this altitude in 30 seconds without the stout walls of the liner's pressure cabin to protect you from low pressure, lack of oxygen, and the frigid dry air.

Some of the perils that lurk "up in the wild blue yonder" would be quickly revealed to a novice if he attempted to invade that region without an oxygen mask, without bothering to get the nitrogen out of his system, or without proper attention to his diet. The latter consists of avoiding gaseous foods, for the air at 35,000 feet is only a quarter as dense as it is at sea level. The unobliging gas expands accordingly, an extremely painful process.



Suppose you climb into a sheep-lined flying suit and stow away on a Flying Fortress. You don't notice the altitude for the first mile or two on the way up. Then you suddenly feel a glow of warmth. This rosy condition is caused by the lack of oxygen, producing an effect similar to several cocktails on an empty stomach. You may feel exhilarated or completely relaxed, depending on your personal chemistry. But you are sure to think that you are the smartest fellow in the world with the ability to do anything.

At 16,000 feet you reach to take a pencil from your coat pocket and stab aimlessly in that general direction, unable to coordinate your muscles sufficiently to get hold of it easily. You get up to walk to the front of the



Lt. Col. W. R. Lovelace (center) who made record jump from 40,200 feet, about to go aloft with Boeing "strato" experts

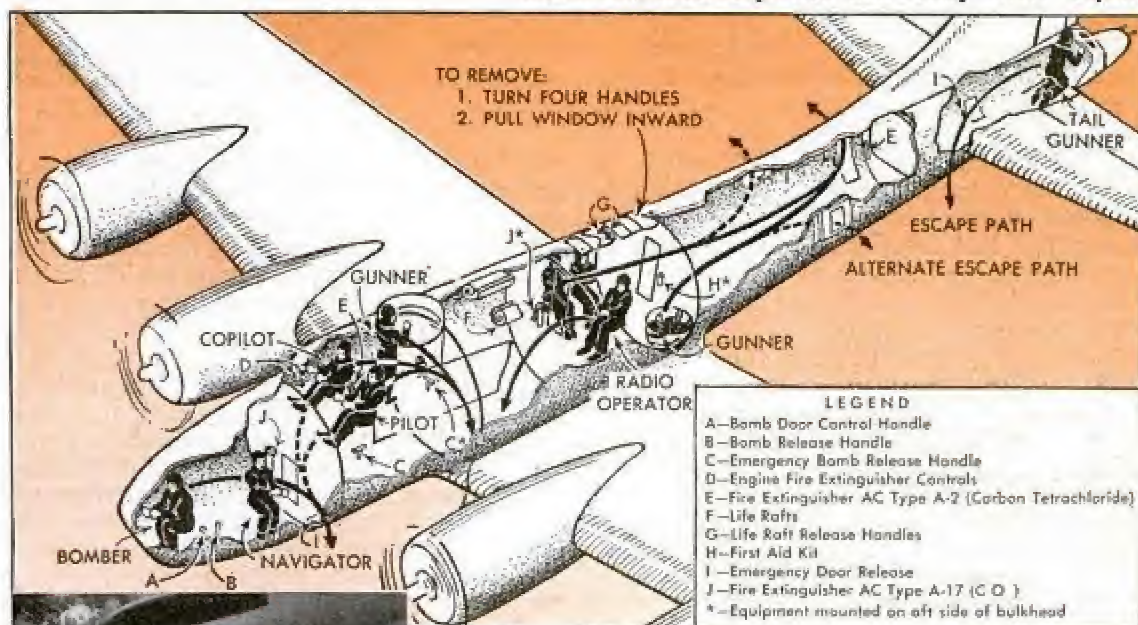


Diagram shows means of emergency escape from a Flying Fortress. Below, Col. Lovelace has parachute gear and oxygen mask checked



plane and stagger like a drunkard. After you are on your feet you forget why you were going to the front of the plane. A thought starts to crystallize in your mind and fades away in mist. Oxygen—that's it—you are starved for oxygen and should get a mask and plug the hose into one of the outlets from the cylinders.

But you haven't the will power to go after the mask. You may suddenly burst out laughing, or weeping. Or you may want to fight—depending on your individual reactions to oxygen lack. Acute oxygen starvation begins at 18,000 feet, and at 20,000 your hearing is dimmed and vision may be blurred. You start trembling. Another couple of thousand feet and your muscles twitch violently. You are delirious. Somewhere around 25,000 feet you will pass out completely, and if you are not quickly revived death will follow.

In contrast to the horrible fate of the imaginary stowaway, the Fortress pilot will be humming along in





Pilots at Mitchel Field, N. Y., do some "cellar flying" in chamber that simulates altitude of 35,000 feet

comfort at the "low" level of 25,000 feet.

But his preparation for a trip into the substratosphere was based on careful research and not the desire for a free ride. Incidentally, test flights at high altitudes cost about \$1,000 an hour, according to Boeing Aircraft engineers. For 24 hours before the flight, the pilot avoided gaseous foods such as sauerkraut and weenies, peanut butter, radishes, or chocolate cake. Forty-five minutes before he was to take off, he put on an oxygen mask with a 50-foot hose attached to a portable cylinder. Then he played baseball with other members of the crew until it was time to take

off. This game, played with oxygen masks and dangling hoses, is one of the strangest sports events ever witnessed.

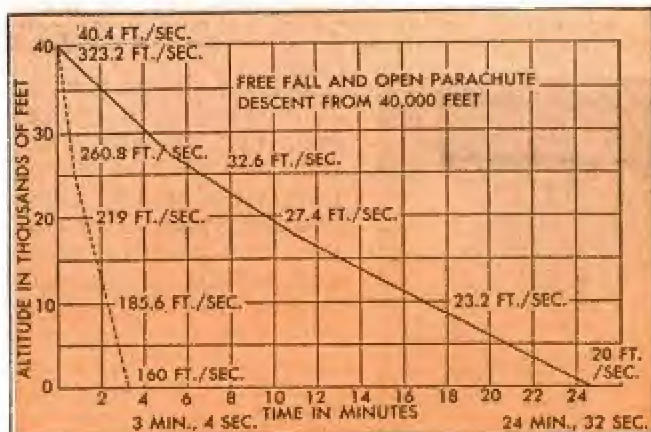
Exercising while wearing the masks and breathing in the pure oxygen which tastes sweet and dry, removes nitrogen from the body. We can get along perfectly without this nitrogen that finds its way into our muscles, blood and joints. When outside pressure changes, the nitrogen struggles to get out. This can cause unbearable pain, and is a condition known to flight surgeons as aeroembolism and to deep sea divers as the "bends." It is unrelated to anoxia, the official term for oxygen starvation. A vari-

High altitude chamber mounted on trailer is taken to air fields to test substratosphere reactions of fliers

U. S. Army Air Forces photo







This chart shows comparative rates for free fall and open parachute. Right, flier in low pressure chamber

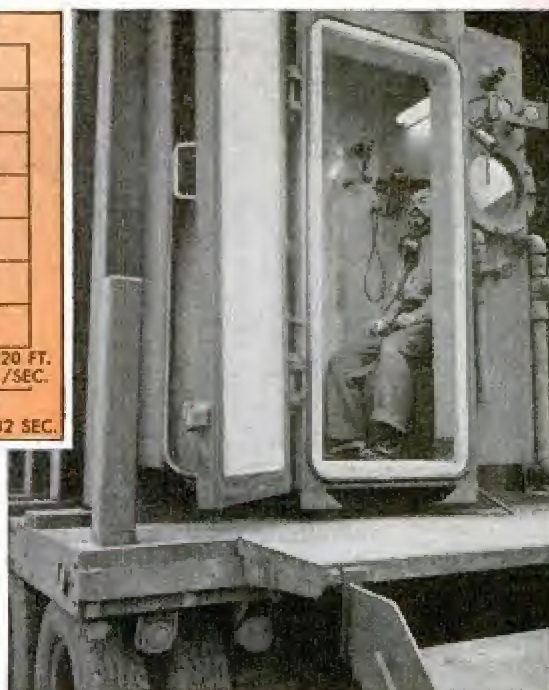
ation is the "chokes," a burning and stabbing sensation under the breast bone caused by small bubbles blocking pulmonary vessels. The formation of gas bubbles at high altitude is similar to the release of bubbles in a bottle of pop. Despite the painful nature of the chokes, bends, and anoxia, they rarely cause permanent harm. If the patient lives through it, the cure is complete.

The Fortress pilot is well versed in the dangers of taking any excess nitrogen aloft in his system. When he completes his denitrogenizing game, he holds his breath while switching from the portable oxygen cylinder to the plug-in system on the plane. There is also a walk-around bottle on the ship in case he wants to move about, and a bail-out bottle that holds an eight-minute supply of oxygen—plenty for an emergency jump from seven or eight miles up.

The pilot is reasonably sure of a comfortable trip for he has fortified himself against anoxia, the bends and frigid air. He is wearing one of the new two-piece chicken feather suits for high altitude flying. His main concern is the cold and perhaps a new filling in one of his teeth. Why high altitude causes pain in new fillings is unknown, but with repeated flights the pain gradually disappears.

Not every man with wings can stand the rigors of high altitude flying. They used to learn that the hard way—actual flying. Now the men are tested in pressure chambers, and those who pass the test for high altitude must stay "aloft" for three hours at a simulated height of 38,000 feet. Cadets call

Fliers exercising while breathing oxygen to rid system of unwanted nitrogen



this "cellar flying." Some of the chambers are mounted on trucks and moved from one field to another.

One of the important lessons hammered into the student flier is that he cannot permit himself to judge oxygen lack. He learns to rely solely on his instruments.

The reactions of an experienced fighter pilot during a recent maneuver show what happens when an oxygen system fails. He

(Continued to page 156)





# 77825 Padded Suit and One-Man Raft Save Navy Men



Quick-inflating Goodyear raft and padded suits protect survivors at sea

Battle dress for the Navy includes padded suits that afford protection from shell fragments, and a quick-inflating one-man raft. The suit, which is padded from neck to thighs, also guards against flesh burns from explosions and cushions the shock of underwater explosions. It weighs just 3 pounds and 12 ounces.

## 77891 Torpedoed Tanker Is Kept Afloat By Air Pump

Compressed air is serving as an anti-torpedo defense weapon on tankers carrying oil for the Allies. An air line attached to a compressor pump extends the full length of the ship. If a torpedo damages several compartments, air is pumped into them to check the inrush of water. Use of the compressor pumps is said to have kept many tankers afloat.

## 77727 Projectors Speed Map Plotting With Stereoscopic Views

With glass plates made from the negatives of aerial photographs, images are projected on a map sheet to speed the making of topographic maps by the Geological Survey. The plates are placed in projection cameras suspended on a supporting bar. Red or green light filters are placed above the diapositive plate in each alternate projector, and when properly adjusted the image can be viewed in third dimension by operators wearing spectacles with special lenses. The operators draw in buildings, streams, or contours on the map sheet. After the drawing is made, it is photographed and taken to the field for the completion survey.



Projectors suspended above map sheet cast images of aerial photographs



# Multi-Gage "Hospital on Wheels" Serves Yanks



Built by the British and turned over to the Americans as an example of "reverse lend-lease," this hospital train is adaptable to any gage railroad in Britain, Africa or the continent, and built to pass through any tunnel, or over any bridge in the European war theater. Above is a view of one of the ward cars, showing the three-tiered bunks, 36 to a car. Below, lifting stretcher case aboard



Extreme emergency cases can be handled in the operating room while the train is in motion, above. Below, external view of the train. Cars are from London, Midland & Scottish Railroad; locomotive is an American-built "austerity" type, built for power; the crew is "all-American"

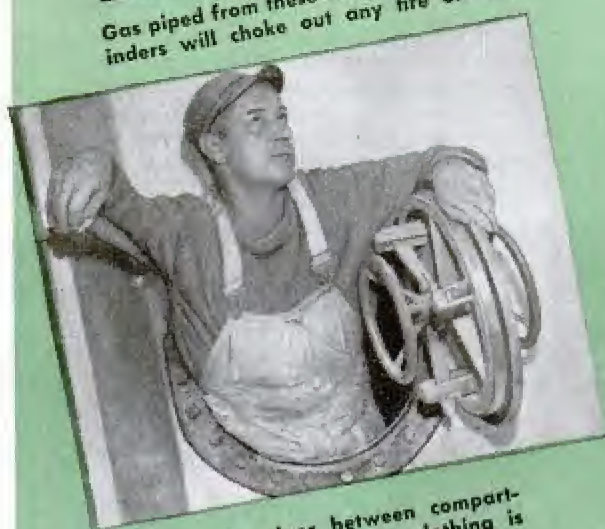




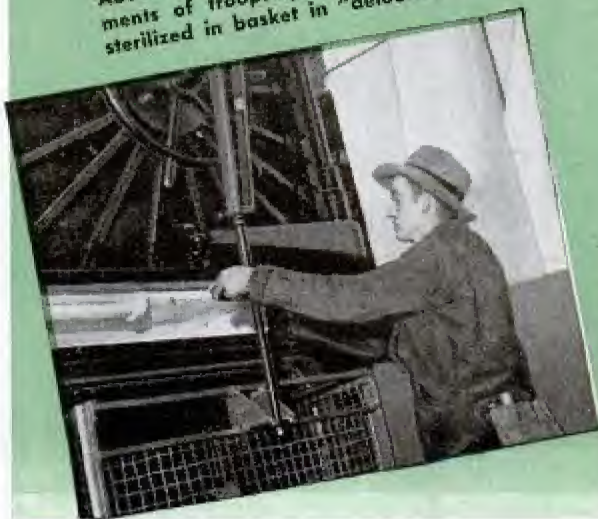
# TROOPSHIPS LIKE "FLOATING CITIES"



Gas piped from these carbon dioxide cylinders will choke out any fire on ship



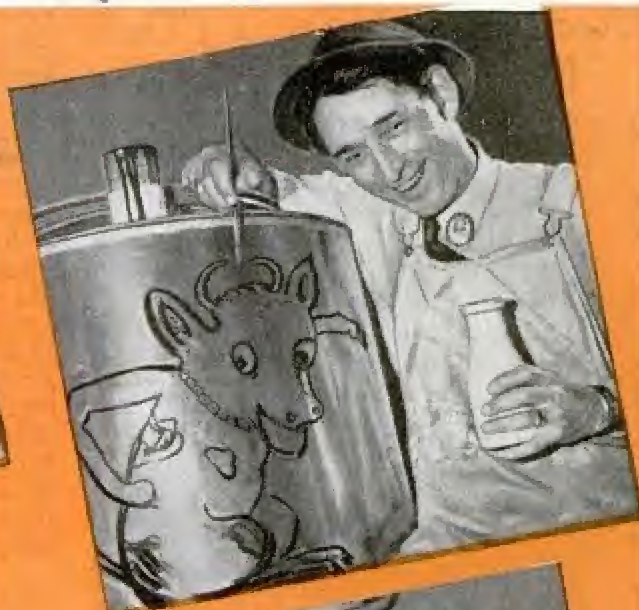
Above, escape door between compartments of troopship. Below, clothing is sterilized in basket in "delousing room"



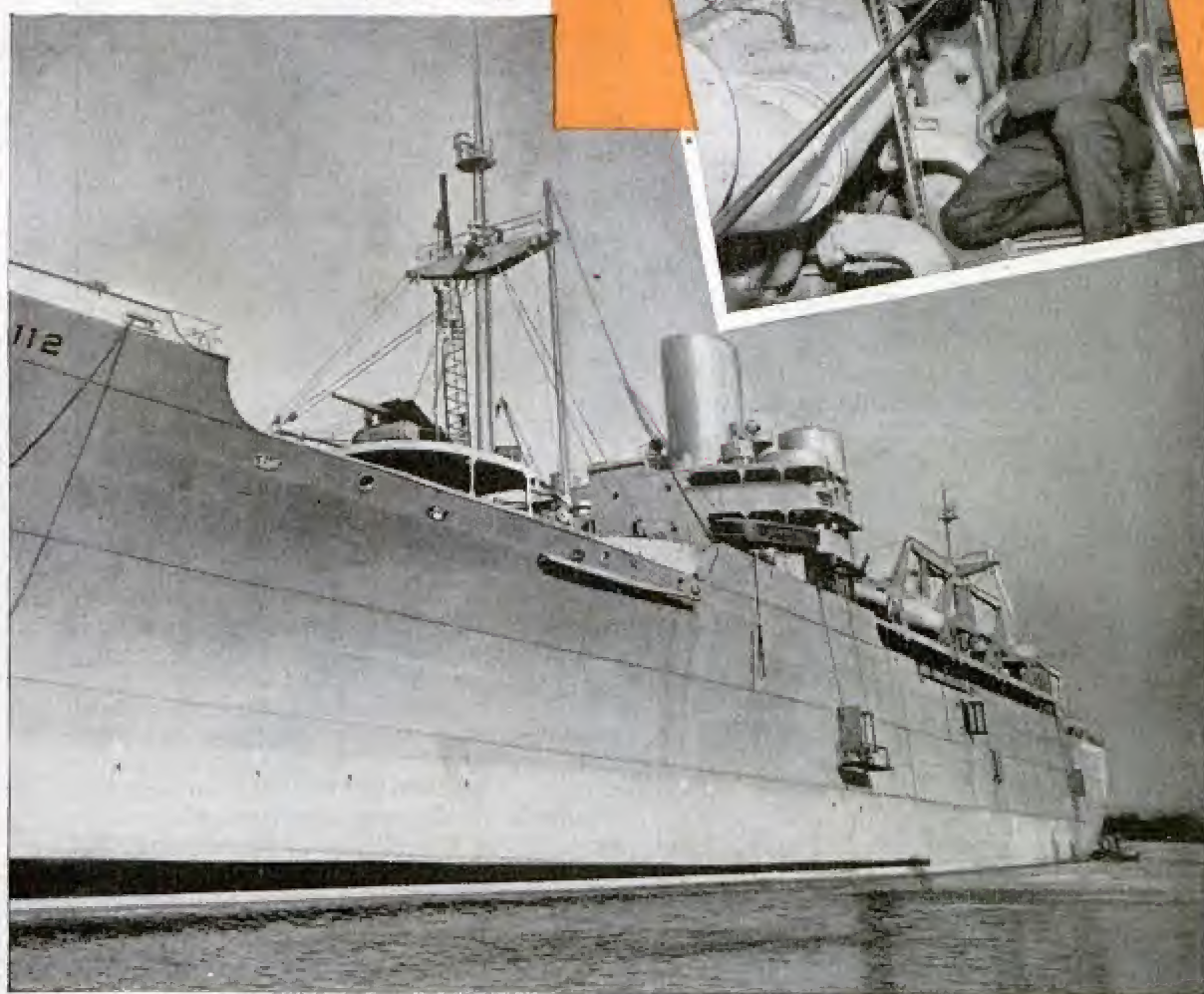
**W**INDOWLESS cities afloat are the giant new troopships already plying the seas to the fighting theaters. Eight decks deep, they are the largest commercial-type ships ever built in the Port of New York and have high-pressure, high-temperature steam plants engineered for speed, fuel economy and global range. There are no portholes to black out. The troops sleep in tiers four deep, in air-conditioned comfort. The ships consume their garbage, leaving no trail for U-boats to follow. Evaporators convert salt water to fresh at 300 tons a day. A mechanical cow takes dehydrated milk, butter and other components and converts them into fresh milk. Many safeguards against fire and torpedo are provided, and in event of disaster there are lifeboats carrying up to 135 men, and 25-man rafts.







*Learn, N. J.*  
 Jamproof doors are provided in troopships built by Federal Shipbuilding & Dry Dock Co., but in emergency lower panel of door is removed (above) to form escape hatch. At upper right is the "mechanical cow" in which butter and powdered milk are turned into fresh milk. At right center, evaporators convert 300 tons of ocean water daily into fresh water, extending ship's range





## 'Rocket Gun' Welding Tool Speeds Ship Building



Plastic machine makes light work of welding ships

With a lightweight plastic welding machine now in operation, women workers in shipyards throughout the nation are said to be vastly increasing their rates of production. The new machine is so readily handled by women workers, and is said to add so much to their speed, that it has been nicknamed the "rocket gun" welder.

## Plexiglas Cup on End of Bone Relieves Pain of Arthritis

To relieve the pain of arthritis, and at the same time make it possible to study the



Capping of the bone makes afflicted joints movable

joint further with X-rays, transparent Plexiglas cups are slipped over the bone head during surgery. The cups are made of the same clear plastic that forms bomber noses and gun turrets. The old surgical treatment relieved pain by making afflicted joints immovable. Now, by removing excess growth on the bone head, the cause of arthritic pain, and capping the head with a Plexiglas cup—said to be a relatively simple surgical technique—painless motion is restored, for the cup acts almost like a layer of lubricant. Dr. Paul H. Harmon of Sayre, Pa., receives credit for the medical work on these cups, which are formed by Croasdale and De Angelis of Plexiglas manufactured by the Rohm & Haas Co. The plastic is slightly flexible, dimensionally stable, light in weight, durable, and unaffected by body tissue and fluids.

## Removable Lugs for Plane Tire Prevent Skidding on Ice



Non-skid lugs are bolted to shoulders of the tire

Airplanes can land on ice or hard-packed snow with a tire equipped with removable sharp steel lugs. The lugs are used in a special tire developed by the Firestone Aircraft Company. It has high projecting shoulders through which the lugs extend to the side of the tire where they are bolted in place. By removing the lugs, the tire is quickly converted for use on regular landing surfaces. Owners of private planes after the war can enjoy year-round flying with one set of these tires.

See the index to find where to buy articles described in this magazine. Say You Saw It in Popular Mechanics.

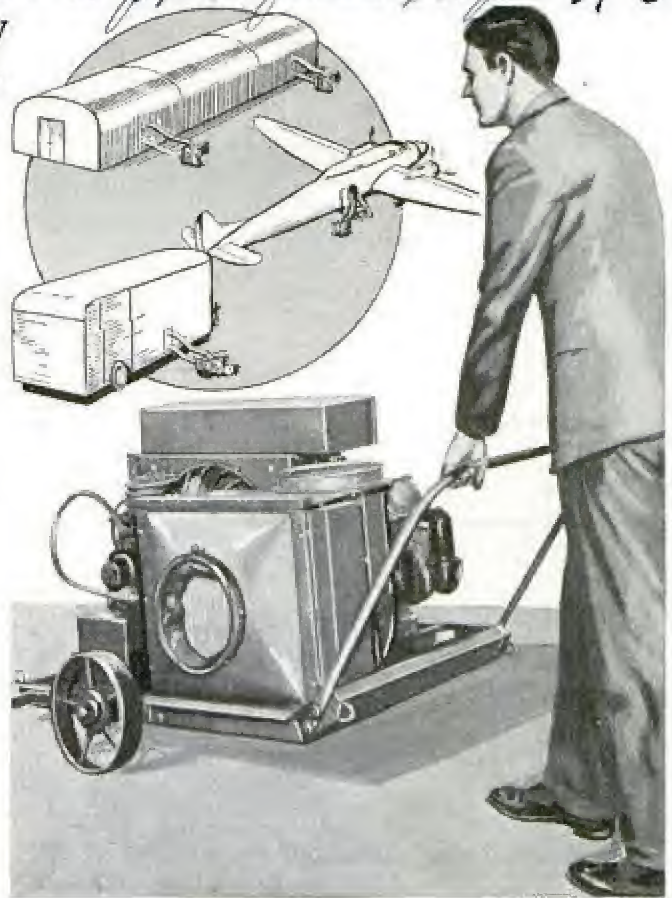


*Carrier Corp., Syracuse, N.Y. 71649*

## Mobile Cooler for Army Removes Stifling Air From Plane on Desert

Inside an airplane grounded on the desert under a broiling sun, mechanics can work in cool comfort with the aid of a mobile cooler and dehumidifier designed for the armed forces. The lightweight unit, which delivers cooled air through canvas ducts, combines cooling with dehumidifying and filtering. The unit could also be used in stifling-hot darkrooms where photographs are developed and printed close to the front lines. In small rooms where radar, radio, or telephone operators must work, and in field hospitals, the portable cooler would bring comfort and added efficiency. It has retractable wheels for hard surfaces, and a sledlike bottom with rings attached for towing over sand or soft ground.

Cooling unit has retractable wheels and sledlike bottom. Cool air is delivered through canvas ducts to inside of plane, hangar or trailer



## Two-Story Poultry House Lets Chickens Scratch Ground

With the rural chicken population at an all-time high of over 500,000,000 birds, and additional scores of thousands in urban areas, the demand for poultry houses has

created a henhouse boom. One two-story chicken house is sold completely set up and ready for use in either town or country. It accommodates 50 baby chicks or nine full grown ones. Made two stories high, it has an inclined cleated trapdoor ramp that lets chickens scratch on the ground.



For town or country—this house accommodates 50 baby chicks

## Incendiary "A-A" Bullet Explodes Self-Sealing Tank

Self-sealing gasoline tanks are exploded with a .50-caliber incendiary bullet that spreads a sheet of fire upon contact. The bullet, developed by the Remington Arms Company, also pierces the thickest armor plate now used on enemy aircraft. The flame is caused by chemicals in the bullet which burn at blast furnace temperatures. Although the bullet was developed for use against airplanes, U. S. fliers sank a Japanese freighter by dropping their auxiliary gasoline tanks on the ship and then exploding them with the incendiary bullets.

FEBRUARY, 1944

*Manser & Kelly Co.*

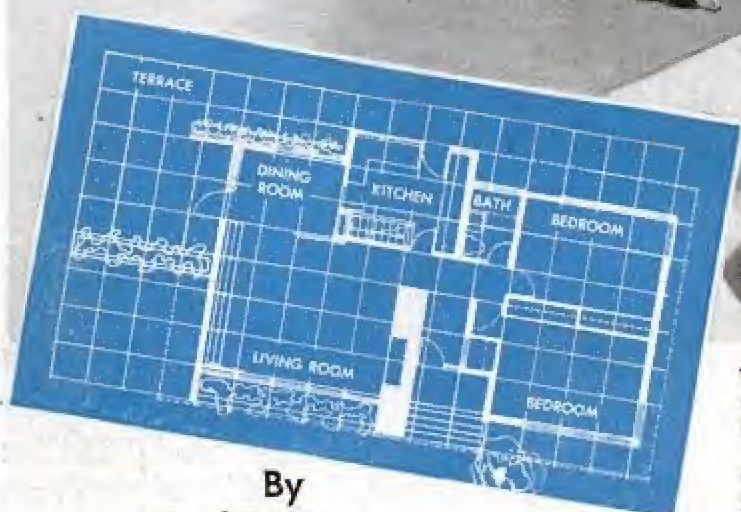
*14-101 Merchandise Mart  
Chicago, 54, Ill.*

*Bridgeport, 17 Conn.*



77 480

# YOUR **VICTORY** HOME



Courtesy Celotex Corp.

This five-room postwar home with many windows captures the spaciousness of all outdoors. Note distinctive chimney

By  
**Carl F. Boester**

Housing Division, Purdue Research Foundation

WITH so much fantasy and wishful thinking being circulated about the "home of the future," it may be well to consider whether we will have evolution or revolution.

Fundamental, scientific research on an ever-accelerated basis is making a real contribution toward better postwar housing. But the people who own the land, risk their capital, and have the "know how" of building construction will be the ones who will decide what to put into the new homes offered to you when victory is won. After the test of time, most of the things you see

or read or hear about will come into general acceptance; but don't put off any plans to build, expecting to see a beautiful snow after the war, with each flake a new, shiny home with all the gadgets of the inventors or planners in it. Look at it from the light of a common-sense comparison with your present or recent home, and then judge carefully which of the many possibilities represents to you the greatest value for the money you will have to spend.

Research has long ago taught us that better housing for less money is dependent on only two things. Whatever the idea, method, or material may be, it must make a direct contribution to either of these factors. The first consideration is the amount of material that goes into your house, for

POPULAR MECHANICS  
120 S. La Salle St.  
Chicago, Ill.

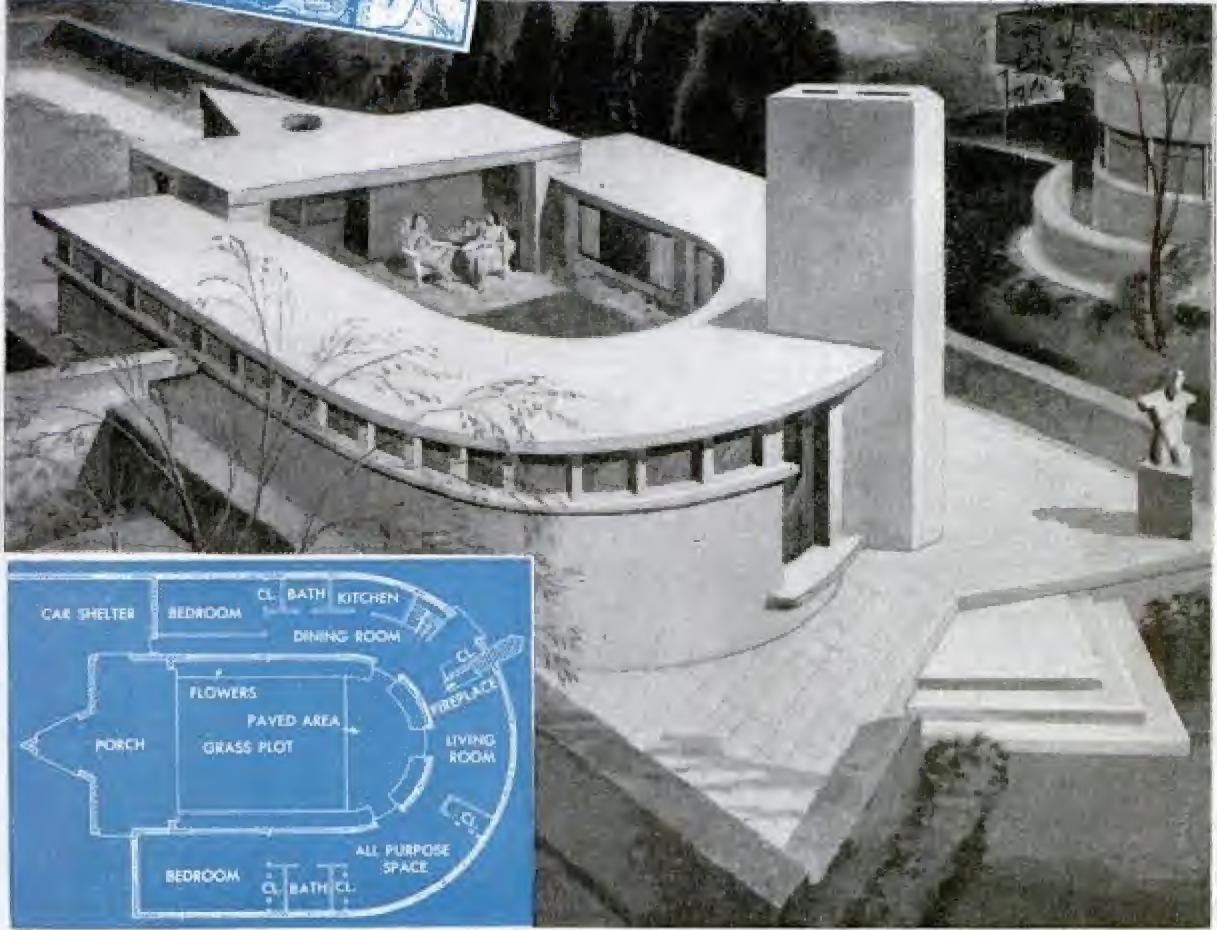


that house is bought and delivered on a cost-per-pound basis. The more material the higher the cost. Take a lesson from the experience of the aircraft designer: he gets greater utility and strength with less material. Intelligent use of materials will make possible the use of less material.

The other consideration concerns the man hours of labor. The average house has over 30,000 parts, each handmade and hand-fitted. Better engineering can cut this number to less than half and still provide a better house. Fewer parts mean less labor and thereby



Libbey Owens Ford Glass Co. photo *St. Louis, Mo.*  
 Built-in waffle iron in the glass kitchen of tomorrow eliminates bother of tangled cords. Left, storm window made of Lumarith plastic is mounted to form attractive bay. Below, "circular" house that was designed for privacy and low cost operation  
 Courtesy of The Tinkin Company - *St. Louis, Mo.*





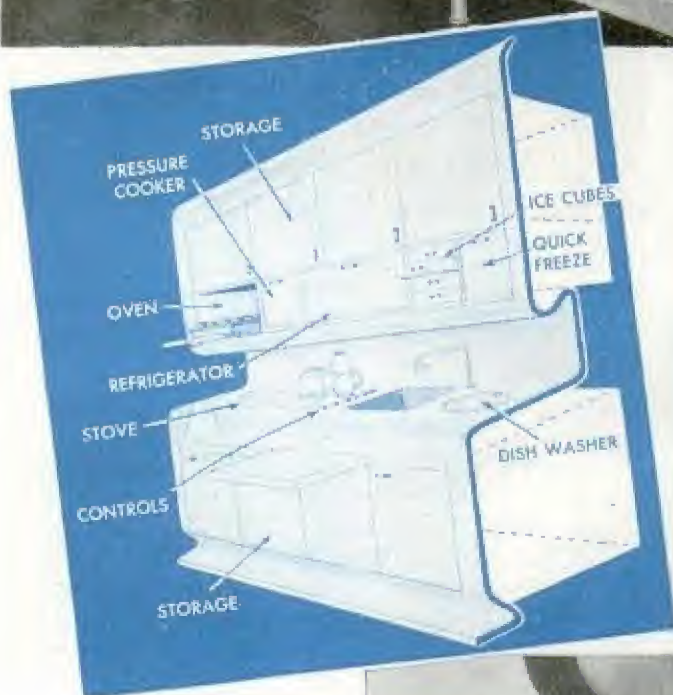


Glass-door refrigerator has revolving center turntable

requiring the maintenance person to be an engineer. New heating units will be simple, compact, foolproof, and semi-automatic. If water is the medium of heat transfer, it will be computed in quarts instead of quantities sufficient to flood a basement when the boiler cracks. The new units won't crack; they will simply expand under pressure, the pressure being released into small tanks supplied for the purpose. The small diameter, short-length pipes will be of materials

that expand when frozen instead of bursting. The room-heating surfaces will be low in temperature, adequate in area, and most likely concealed in the ceiling to radiate warmth like sunshine.

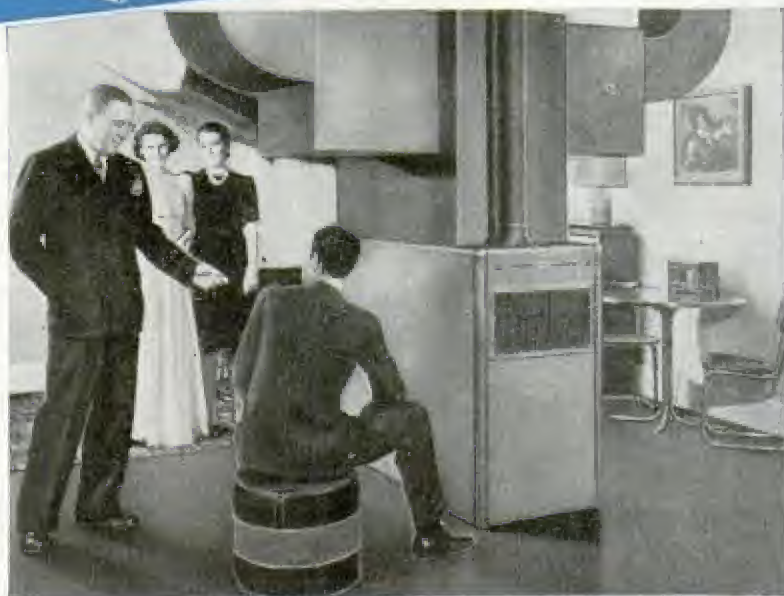
If heated air is your preference, you will get it without drafts, dust, or air-borne germs. Your house will be cleaner than you have ever known it, for your windows, though large and spacious, will be permanently stationary. Fresh invigorating air, filtered and tempered, will be introduced in the right amount at



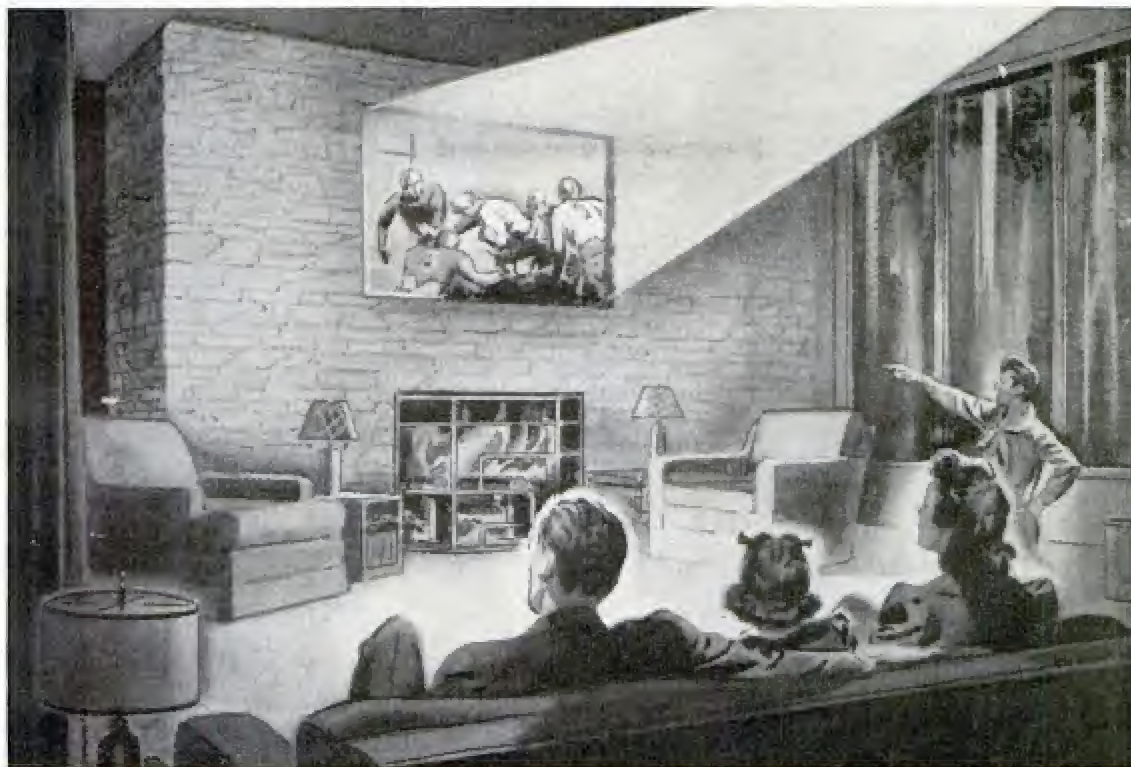
This compact kitchen unit combines a stove, refrigerator, sink and storage space. Below, a Servel air conditioner

lower cost. Lower cost for the finished homes means more houses. More houses means more work for labor at good wages. If the new ideas or methods fit one or both of these factors, the end result is better living for less money.

Four walls and a roof of any combination of good materials makes a "house"; but it's the little things that make it a "home." Take the matter of home heating — before the war the trend was to huge, complicated devices







Courtesy Celotex Corp.

the right time for adequately healthful ventilation. If you don't open your windows, the twice-yearly chore of moving screens will be unnecessary. Their cost and maintenance will also be saved. Many hours a month will be saved by less dusting of furniture too.

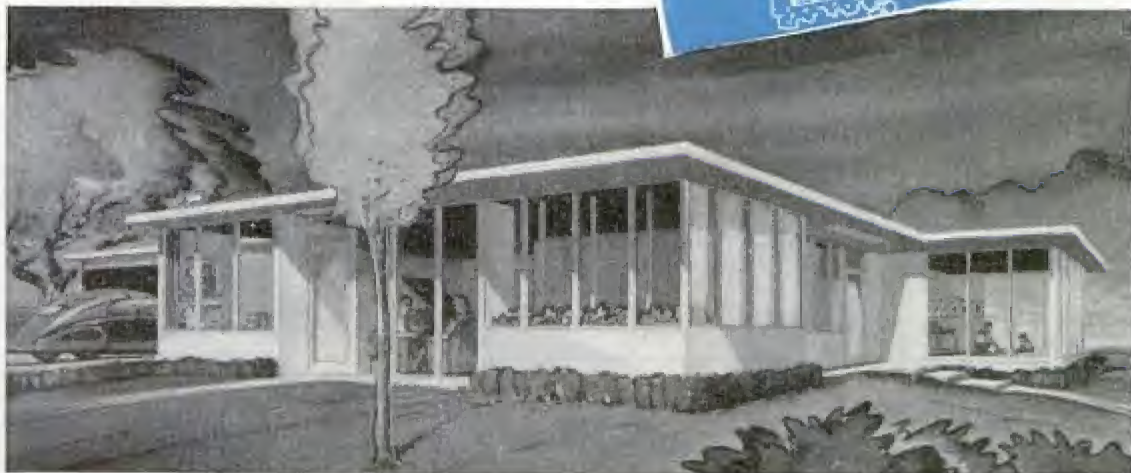
Summer cooling? Home refrigeration will be costly, but some of the simpler practices will still be popular, such as attic ventilation or more insulation to keep out heat. Refrigeration-actuated room coolers of the portable or window type will find wider use for cooling bedrooms at night and the living room by day.

Electricity will be a greater servant than

On television screen above the fireplace in postwar home, family watches a football game. If the game is dull, the touch of a button will change gridirons



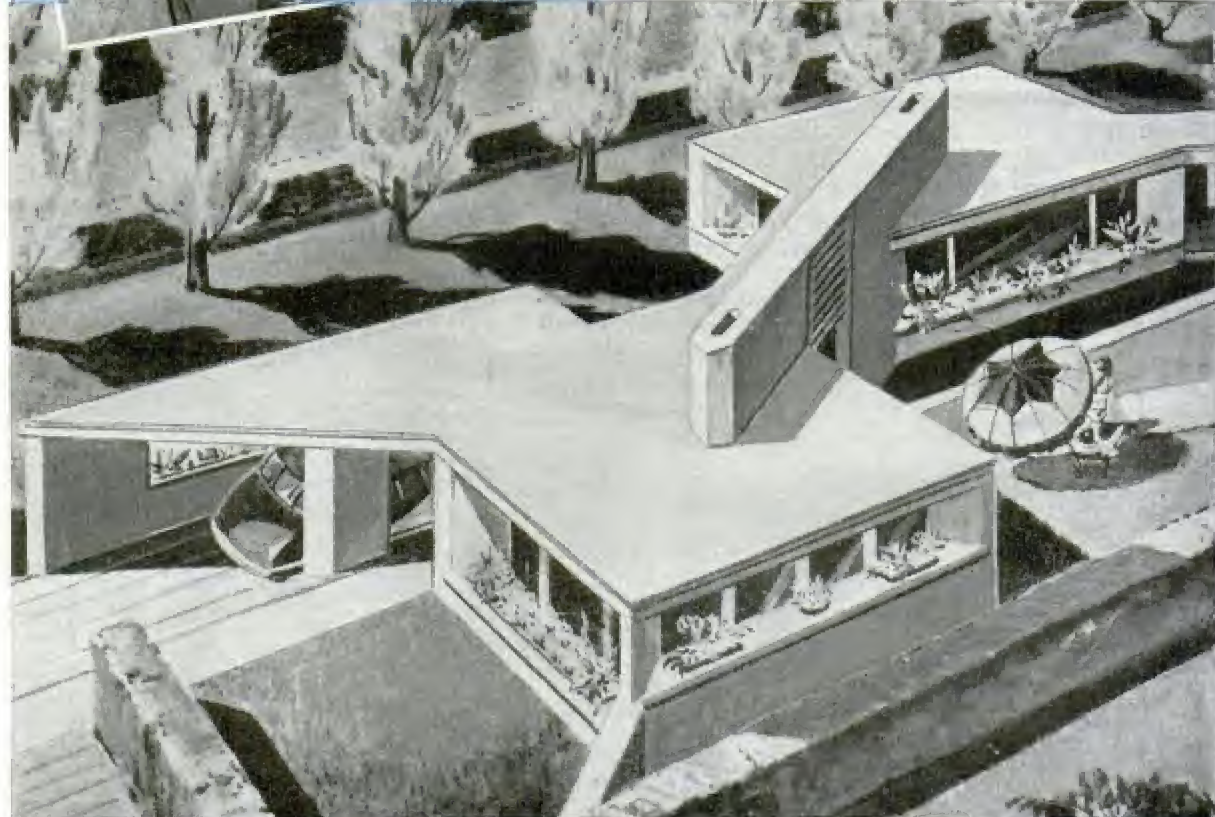
In this "sunshine" house, heating, cooling and refrigerating machinery and all pipes are located in central shaft







Window sill of the circular dinette is made of Westinghouse green Micarta. Below, tool room has special sink to facilitate the potting of plants



ever. Wall and ceiling treatments will be adapted to the type and size of illuminating equipment to provide better vision at less cost. There will be several new paints. Their base will be of the numerous types of plastics that will be available; and their pigments and other ingredients will be the new fluorescent type of compounds that will be quite sensitive to light, a quality which will make possible the use of considerably less electrical energy than is now required to get the desired degree of illumination. These paints also, when required, have the characteristics of absorbing predetermined quantities of daylight and thus will provide greater brightness on cloudy days and additional illumination at night. Many lighting units will have auxiliary energy lamps giving off rays equivalent to the beneficial rays of the sun while at the same time killing harmful bacteria that may be floating around the room.

Paints and protective coatings will be available in still greater varieties of color; they will be far more durable and will stand washing much better. Metal foils of many colors can be used for permanent types of finishes. Glistening floor finishes with unusual wearing qualities will be common.

Wiring systems will be adequately heavy to carry the loads of our ever-





Courtesy of Libbey Owens Ford Glass Company.

There's nothing hidden—including the roast—in this postwar kitchen. Cover of stove lifts and slides back

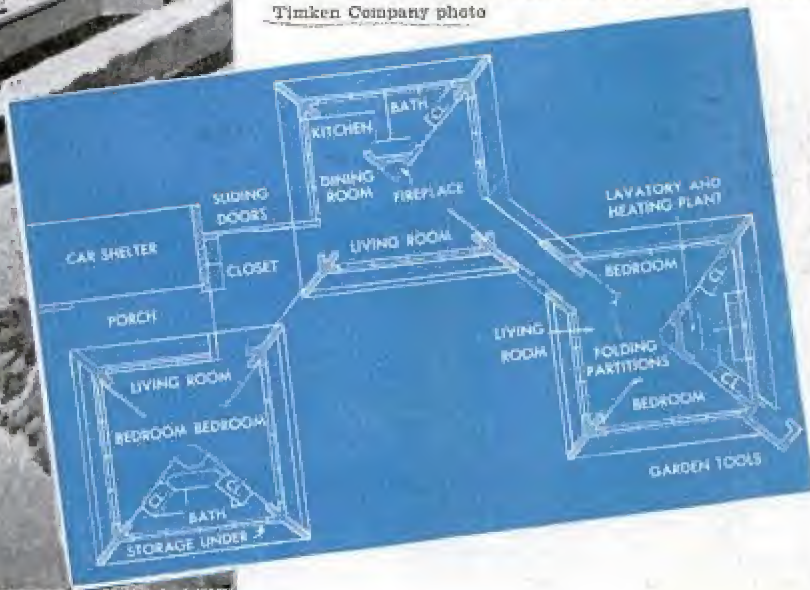
*Nicholas Bldg., Toledo, Ohio*

increasing appliances. They will be of the continuous type with convenient outlets every few inches instead of one per room or per wall. For the shop-assembled home,

sometimes mistakenly called prefabricated, the wiring system will come made up in one assembly like today's auto ignition system, ready to fit into the completed unit.

Bathrooms and plumbing systems will be better and simpler. Floor plans permitting a bath next to the kitchen will become more popular, effecting real savings in plumbing costs. Experiments now going on indicate that methods of waste disposal other than

The "multi-unit" house can be built in three sections; the center unit has three rooms and a bath  
Timken Company photo







Photographed at Carson Pirie Scott & Co., Chicago  
Folding screen for bedroom is attached to the wall.  
Right, screen is pulled out around the baby's bed

by water carriage will come into use. We can expect to save huge quantities of this costly and sometimes precious fluid—water.

Kitchens and laundry—well, the ladies are going to have to fight this one out, the ideas are too numerous to mention. New methods of food storage and preparation are going to make our old friends, the stove and the refrigerator, considerably different. Only about a third of the energy put out by the burner of your stove is needed to cook the food; the rest is lost. You are bound to see some economy here. Then again, why heat a big unit for one dish? Why not use a well-designed appliance? Different-sized appliances for particular purposes would be desirable.

Garbage disposal? This depends on your waste habits and the quantities involved. It is quite likely that combination incinera-

tors and water heaters will be generally used, because there is plenty of heat in the waste products of most homes.

We could go on and on with the various component parts of a house and those things in it that make it "home." You must understand this one point: a good house is a wise integration of many materials and units; the "all this" or "all that" house just won't work. The universal units won't do for the kind of materials you put in your house, and the method of assembly



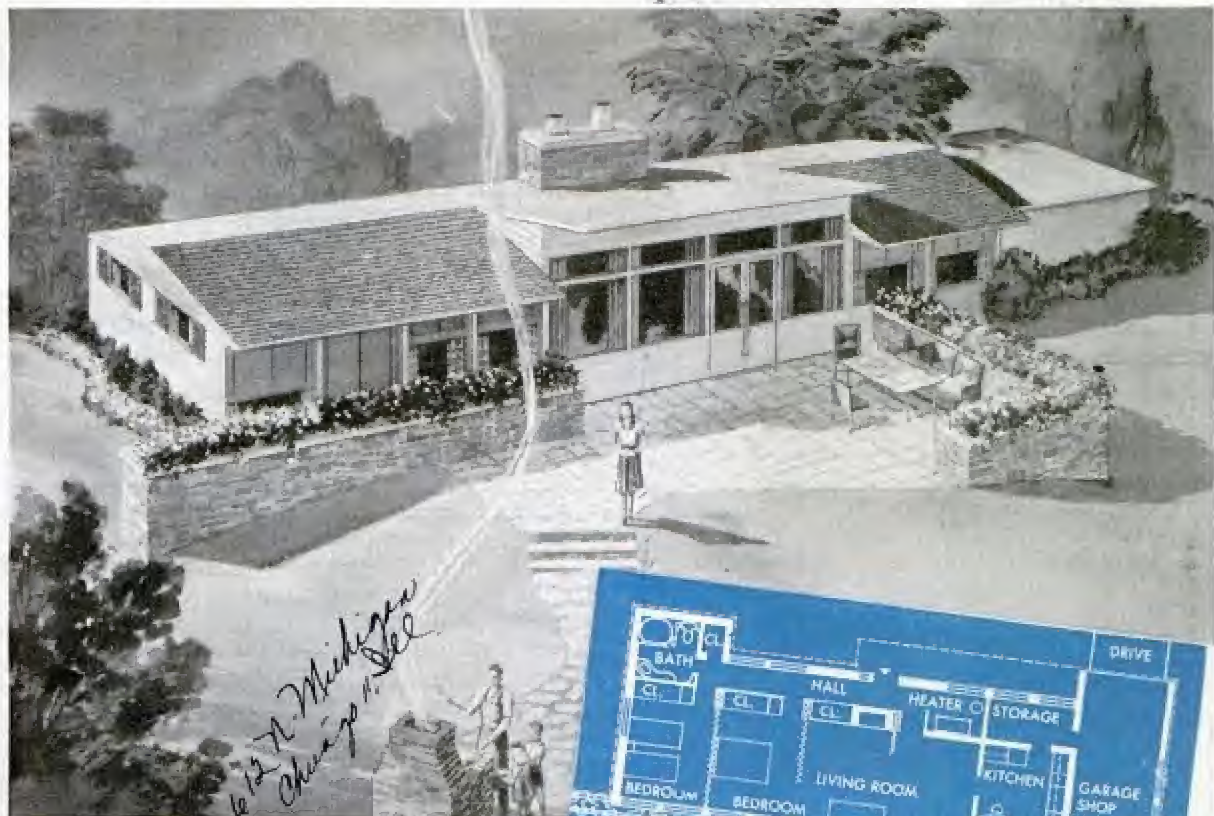
definitely limits and affects the size and kinds of equipment to give the greatest performance at the least cost.

The greatest of all barriers to happier housing is the average person's gross ignorance of what he is getting in housing and why he is getting it. There really is no mystery in house construction, its materials or equipment. It may be a while yet before the market can provide a new home for you. Won't you, in the meantime, make it a point to study carefully all you can about housing so that you can know how to get full



A typical modern residence in suburbs of Sao Paulo, Brazil





Architect, George Fred Keck  
House faces south to make use of solar heat. Wavy lines between rooms on the floor plan indicate movable partitions

value for the money you plan to invest?

For example, take the choice of fuel for heating your home. Many have the erroneous thought that the price of fuel is the controlling factor. It is true that coal, for instance, is much cheaper than gas on the basis of the cost per thousand heat units but there is also ample evidence that many homes are heated at a less cost with gas than with coal. The basic reason for this is that the over all efficiency is so low that it is possible to heat with gas for less than the cost per year for using coal under the same conditions. The people designing and selling gas-fired heating equipment make it a point to see that gas-fired equipment operates with the highest efficiency possible. The fact that you have a cheaper fuel is no guarantee of a low cost.

It is quite possible by careful engineering and installation to get real efficiency from coal-designed equipment, of course.

The whole point of this illustration is not to debate the merits of a fuel but to point out that it isn't what you decide to do or use that counts but how you go about it. That is your final guarantee of low initial

cost and low operating cost. If you apply this reasoning to each of your housing problems, whether it is heating, plumbing, wiring, or painting, you will then have reasonable assurance of getting the best possible value for your house dollar. Finally, remember it's proper judgment about the number and quality of the little things that makes the difference known as "home."

Particles of dirt and smoke are trapped in electronic chamber installed in cold air return of furnace

Westinghouse photo





*General Electric Co.*  
*Columbus City, Indiana*  
**Below-Zero to 1,500 Degrees**  
**Is Range of Supercharger**



Tightening impeller that sucks frigid air into unit

In a space of 18 inches, superchargers on bombers in the stratosphere are exposed to temperatures ranging from 67 degrees below zero to 1,500 degrees above. On one end of the supercharger's shaft is the impeller that sucks in the frigid air. At the other end of the same shaft is the turbine wheel driven by the hot exhaust gases from the bomber's engine. Wheel and impeller revolve at speeds of more than 20,000 revolutions a minute.

**Rivet Gun for Unskilled Worker**  
**Weights Only 3¾ Pounds**

Rivets are quickly set with a hand-operated rivet gun designed for the unskilled



A turn of the handle sets rivets without pressure

worker. All the operator has to do is locate the hole, turn a handle, and the rivets are set. The gun, which weighs only three and three-fourths pounds, is said to operate without vibration. It can be used on unsupported sheets of thin metal without buckling because no pressure is applied to the plate itself. The gun can be reloaded in 15 seconds, and the rivet length changed in 45 seconds. It is said to be ideal for women workers.

**Compressing Dehydrated Food**  
**Saves More Shipping Space**

Increasingly, food for the fighting fronts and for lend-lease shipments is being transported in compact blocks, so compressed as to save from 20 to 80 percent of the shipping space required for even dehydrated foods. Dehydration of carrots, for example, saves a great deal of space; but the dehydrated vegetable is then so compressed that sufficient for 60 servings is compacted into a brick 2¼ by 6½ by 4½ inches, and weighing 2¼ pounds. Foods successfully compressed include also beets, onions, cheese- and pea-flavored soya soups, eggs, and flour. The compressed carrots and eggs retain more Vitamin A than when uncompressed, it has been found.

**Hand-Cranked Washing Machine**  
**Made From Gasoline Drums**



Crank whirls ladles in upper drum to wash clothing

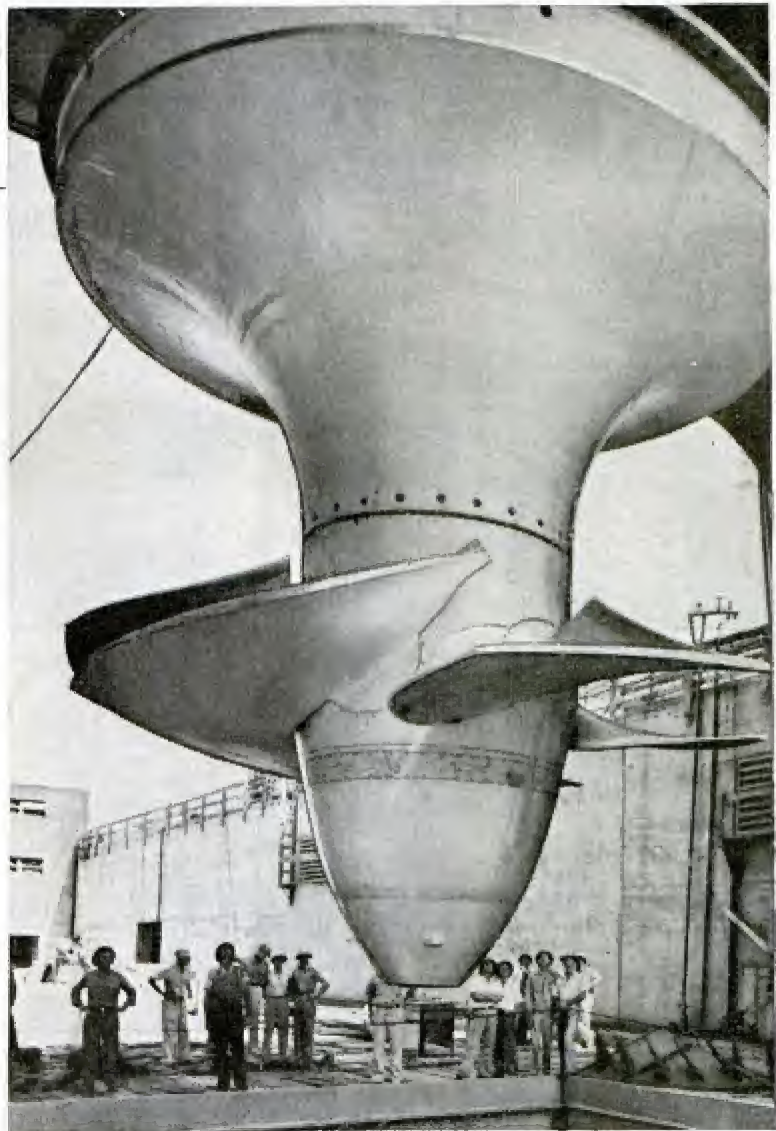
Two gasoline drums and a pair of ladles solved the laundry problems for a pair of Yankee sergeants on Guadalcanal. The bottom drum was cut away to act as the firebox, with the upper drum fitted into the portion removed. The top drum is the washer proper, being fitted with the ladles, which are activated by a hand crank.



71697

# 218-Ton Waterwheel in Dam Spins Like a Top

Weighing 218 tons, a giant waterwheel known to engineers as the "turbine runner" will drive the first generator to be installed at the Tennessee Valley Authority's Fort Loudoun Dam. The big wheel will move the generator at the rate of 105.8 revolutions per minute, developing 32,000 kilowatts of electricity. The turbine runner will develop some 44,000 horsepower.



Huge "turbine runner" moves the generator to develop 44,000 horsepower

*M. J. Navy 71769*

## Day's Water Supply For Man on Raft De-Salted Quickly

Experiments at sea have demonstrated the effectiveness of a new chemical method of removing the salt from sea water, to make it fit to drink. A day's supply of drinking water can be produced from sea water in 20 minutes, as against an hour's time by the older method. By both methods, the castaway gets drinking water by sucking through a tube jutting from the bottom of a bag in which ocean water and a chemical are mixed. The newer method requires only one bag and one chemical.

*71681*

## Hydraulic Tailgate Loader on Truck Lifts 1,500 Pounds



One man can unload heavy cargoes by the use of a tailgate loader, hydraulically operated. The unit, depending on the model, lifts from 750 to 1,500 pounds. Its five-inch hydraulic cylinder automatically halts at ground or body level. One lever controls the descent, rise, and the locking of the gate with its load in any intermediate position. When raised, the unit locks to the truck body and acts as tailgate.

With a turn of the lever on tailgate unit, one man unloads heavy crate

*Anthony Co., Inc.  
Theater, Pa.*



*District 12th Naval District  
Pacific Fleet Office  
7/563*

# CRASH BOATS to the RESCUE

*Federal Office Bldg.  
San Francisco, Calif.*



Wherever much over-water flying is done Navy crash boats stand by, at all times ready to speed to rescue of cracked-up plane's crew. Above, inflatable rubber sphere may be attached to prevent a plane's sinking. Left, lights used in night rescues. Below, man on deck is ready to toss line to occupants of disabled plane

THE boat crews were asleep in their shore bunks when the shout rang out "Man your crash boats!" and the alarm gong began its steady clanging.

Feet pounded on the boathouse deck, marine engines, which had been kept warmed up ready for action, barked and caught, and within 22 seconds the first rescue boat was roaring out of its slip. Its get-away was so fast that a last man who had raced along the mooring finger and dived for the wheelhouse almost missed. He barely landed on the boat's stern.

Somewhere out in the bay, in the black night, an airplane had crashed. No one on the boat had any idea of where the accident had happened or where they were going. There had





been no time to find out, for the crash boat's sole job at present was to get away from its mooring and out into the bay.

The powerful twin engines were wide open now and the boat was throwing sheets of spray from its bow as it got up to a steady 35 knots. In the wheelhouse a sailor snapped on the radio receiver and presently their orders came in.

"Crash Boat No. 1. Crash Boat No. 1. A plane went in about seven miles northeast of Coyote Point. Report on the area and pick up any survivors."

The coxswain altered his course, the radioman climbed up on the roof to be ready with the searchlight, and ten minutes later the boat began to slow down as it reached the searching area. No wreckage could be seen. The coxswain turned the boat into the wind, the wheelhouse windows were dropped, and everybody on board began to sniff for the characteristic odor of super high octane aviation fuel.

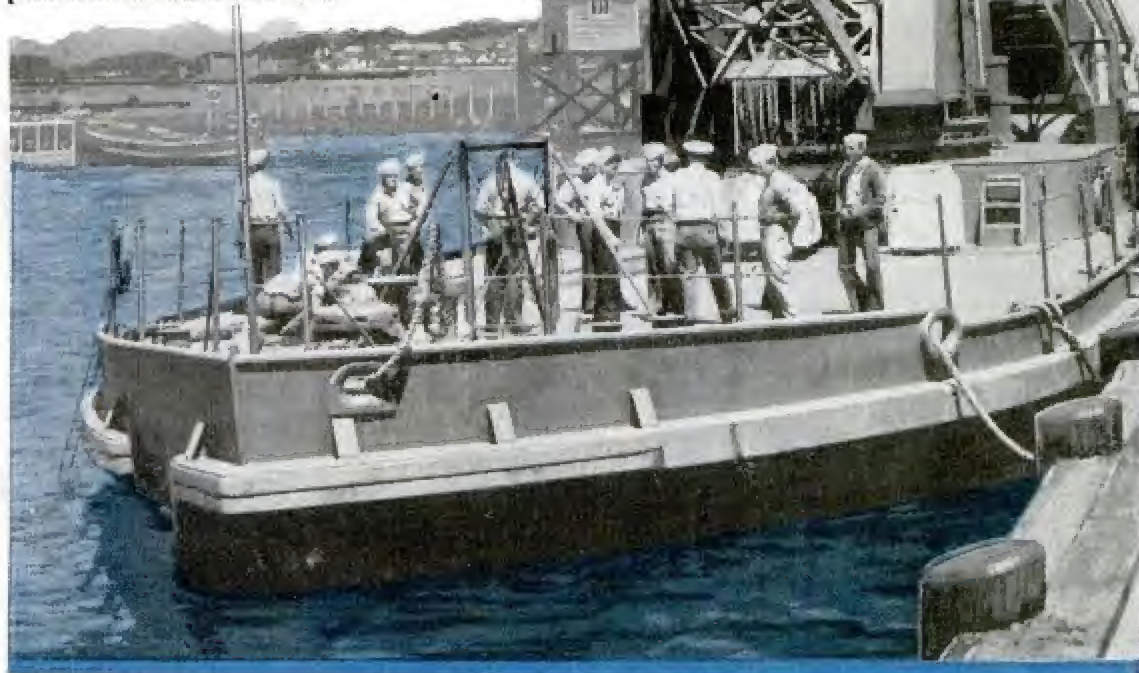
Presently they smelled it. Gasoline, bubbling up from the ruptured seams of the gasoline tanks on the submerged plane, was revealing its location by

its odor. Now the rescue crew began to see widening patches of lubricating oil on the water. The boat was turned again to move with the tide and then, almost immediately, the searchlight picked up a floating object. It was a flyer, supported on the surface by his Mae West, but face down in the water and motionless.

Getting the unconscious man on board and under the care of the pharmacist's mate was quickly accomplished. By now another crash boat, that had been held at the boathouse until the doctor had jumped on board, had arrived on the scene and the two boats were brought together so that the doctor could take charge of the first aid.

Water is a harder substance than solid ground to an airplane that crashes in it. Unless the pilot of a disabled craft can land at just the right angle the plane is torn apart by the impact. Often the engine breaks away and sometimes the crewmen are catapulted from their seats. They are rarely injured badly. Either they are killed outright or hardly hurt at all, though in the

Salvage barge's crane can lift a plane from the water to the deck







Dressing diver for trip to inspect a submerged plane

latter case they are often knocked out by the shock. A few minutes of delay in rescue, even a number of seconds, may mean death to a man who is lying unconscious or semi-conscious in the water.

For that reason in areas such as San Francisco Bay, where considerable over-water flying occurs, the Navy maintains rescue crews whose principal duty is to be prepared, night and day, to go to the scene of a water crash. In the Bay area, for instance, there are more than 300 square miles of water. Crashes are not very frequent, of course, yet when a Navy or Army plane does fall in the water, aid can be on its way almost at once.

The rescue crews are picked men, chosen not only for their knowledge but also for their ability to get going in a hurry. They are constantly trying to break their own records because they know their speed may save lives.

The rescue organization operates under the same rules as do members of a fire department. Meals are eaten in rotation so that part of the crew is always ready for duty. The men sleep in the boathouse. Engines of the crash boats are warmed up every few hours so that they are always ready to start. A special telephone in the boathouse is attached to the crash circuit that feeds from the control tower of the adjacent naval air station.

The crash boats are big 45-footers, heavy and sturdy enough to maintain high speed through rough, choppy water for inshore work, and 63-footers for offshore and long-range sea rescues. Each is powered by twin engines that deliver a total of 1,300 horsepower. The engines take up the main portion of a boat's midship section, with the wheelhouse forward and a cabin fitted with bunks and stretchers aft. Life lines are rigged on deck for safety in rough weather.

Each boat has a two-way radio, tow lines and wing lines, a complete first aid kit, an oxygen inhalator, searchlight and floodlight, a crash chest filled with cutting and salvage tools, and other rescue equipment. Overhanging the bow is a boom that can support a ton. With this boom, buoyancy can be given to a wrecked aircraft that is threatening to sink.

In addition each rescue boat carries a set of flotation gear, consisting of two large rubber spheres that may be inflated from a self-contained carbon dioxide bottle, and that will buoy up a sinking plane to the

Speed is the secret of the crash boat's lifesaving technique. Note boom on bow to help keep planes afloat





extent of three tons per flotation cell. The flotation sphere may be stuffed inside an airplane's cabin and then inflated, or it may be tied to the plane's exterior.

Marker buoys are also carried to mark the spot when an airplane sinks. Each crash boat, too, carries a collapsed rubber life boat with a capacity of 14 men, that may be inflated and used to reach a crash in shallow water where the bigger boat can't operate.

Rescue of personnel comes first, then the salvaging of equipment. One

**Crash boat's pharmacist's mate demonstrating oxygen inhalator**



**Above, towing seaplane, disabled by motor trouble. Right, crash boat speeds off on an emergency call**

crash boat speeds back to its base, carrying injured men direct to a waiting ambulance. The other crash boats tie onto the airplane or its wreckage and try to keep it afloat. Usually the actual salvage operations must wait for the arrival of the "Mary Ann," as every big salvage barge attached to the Navy is unofficially known.

Such a barge may have a huge overhanging crane with a capacity of 50,000 pounds. A big "Mary Ann" can pick up a disabled flying boat with ease and lay it gently on deck to be carried back to the base. Diving gear is also carried on the salvage barges so that men may descend to a sunken wreck to attach hoisting cables.

The sequence of salvage is first to recover the engines and armament of an aircraft, next its instruments, and finally any

(Continued to page 156)

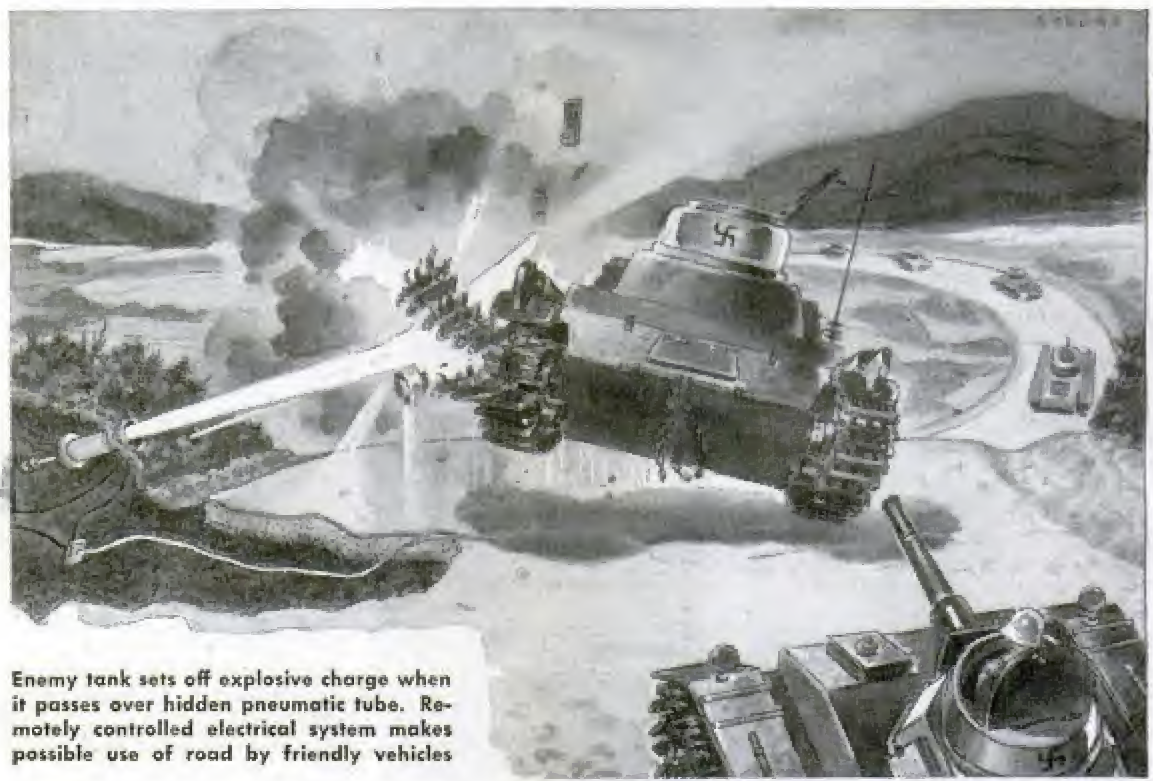




Don't Clyde B. Cap  
Fort Ord, Calif.

Patent # 2,330,205  
7163

## Pneumatic Tubes Set Off Bombs at Side of Road



Enemy tank sets off explosive charge when it passes over hidden pneumatic tube. Remotely controlled electrical system makes possible use of road by friendly vehicles

Without use of land mines which necessitate digging up a highway, an entire column could be blasted with a series of mortars and projectors buried along the roadside. They are connected to hidden rubber pneumatic tubes, similar to those used to summon attendants in filling sta-

tions. A remotely controlled electrical system permits friendly vehicles to use the highway. This method, for which a patent was recently granted, is said to be especially useful along paved highways where the firing tube can be concealed effectively along the joints.

## "Three-Level" Bridge in Jungle Shows Yank's Versatility



U. S. soldiers prove there's more than one way to cross a jungle stream

Any jungle fighter will tell you there's more than one way to get across a river without getting wet. Among the various types of bridges built by U. S. troops are those just above water level on floating supports, a bridge composed of two strands of rope—one to walk on and the other to hang on to—and the conventional type of swinging bridge. When Gen. Douglas MacArthur inspected a division training for the big push on the Lae front, the soldiers staged a "triple crossing" demonstration over a tropical stream. The effect was that of a three-level bridge.



*Major J. A. Brindley, Executive Officer, Technical  
Service Div., Office, Post. Chief of Army Staff,  
Washington, D. C.*

## Crew Packed Like Sardines for Crash-Landing

At the pilot's warning that he is about to make a crash landing, crewmen of a United States bomber are instructed to take positions in the radio compartment, so they won't "rattle" when the crash comes, as one Air Forces major puts it. Three of the men take positions like a bobsled team, while three more lie, head against one bulkhead, feet against another. All are braced for the crash. Such cramming together, sardine fashion, in the reasonably secure radio section has been found the safest procedure.

Braced against shock of crash landing is bombing plane crew  
U. S. Army Air Forces photo



## "Bug" Mounted on Automobile Hunts Seabees for Navy



If you encounter a giant and ferocious-looking bug moving at 35 miles an hour along the highway, don't consult your doctor. This bug, mounted on an automobile, is out hunting recruits for the Navy Seabees. In the bug's "six hands" are tools and guns. The recruiting car was built at Camp Peary, Va., the naval construction training center.

This Seabee carries tools and guns in its six "hands"

## Glass Fibers Add Strength to Plastic Used in Molded Plane Parts

Hitherto unattainable strength, in proportion to weight, is claimed for a plastic reinforced with glass fibers, suitable for molding into aircraft structural parts with low pressures, and without the use of expensive molds. Experimental samples have shown a tensile strength of over 80,000 pounds per square inch. While the impact strength of ordinary plastics is about two foot-pounds, on a standard test, samples of the glass-plastic combination have shown impact resistance of over 20 foot-pounds. The material can be machined and has the

dimensional stability of metals. As an explanation of its strength, it is claimed that when glass is drawn into fine fibers and combined with a plastic, the imperfections are so distributed that there is almost no chance that faults in one fiber will match with those in another. Consequently, the finer the fiber, the wider the distribution of imperfections, and the smaller the possibility of a major, cumulative imperfection. Glass fibers now have an average diameter ranging down to 23 one hundred thousandths of an inch.

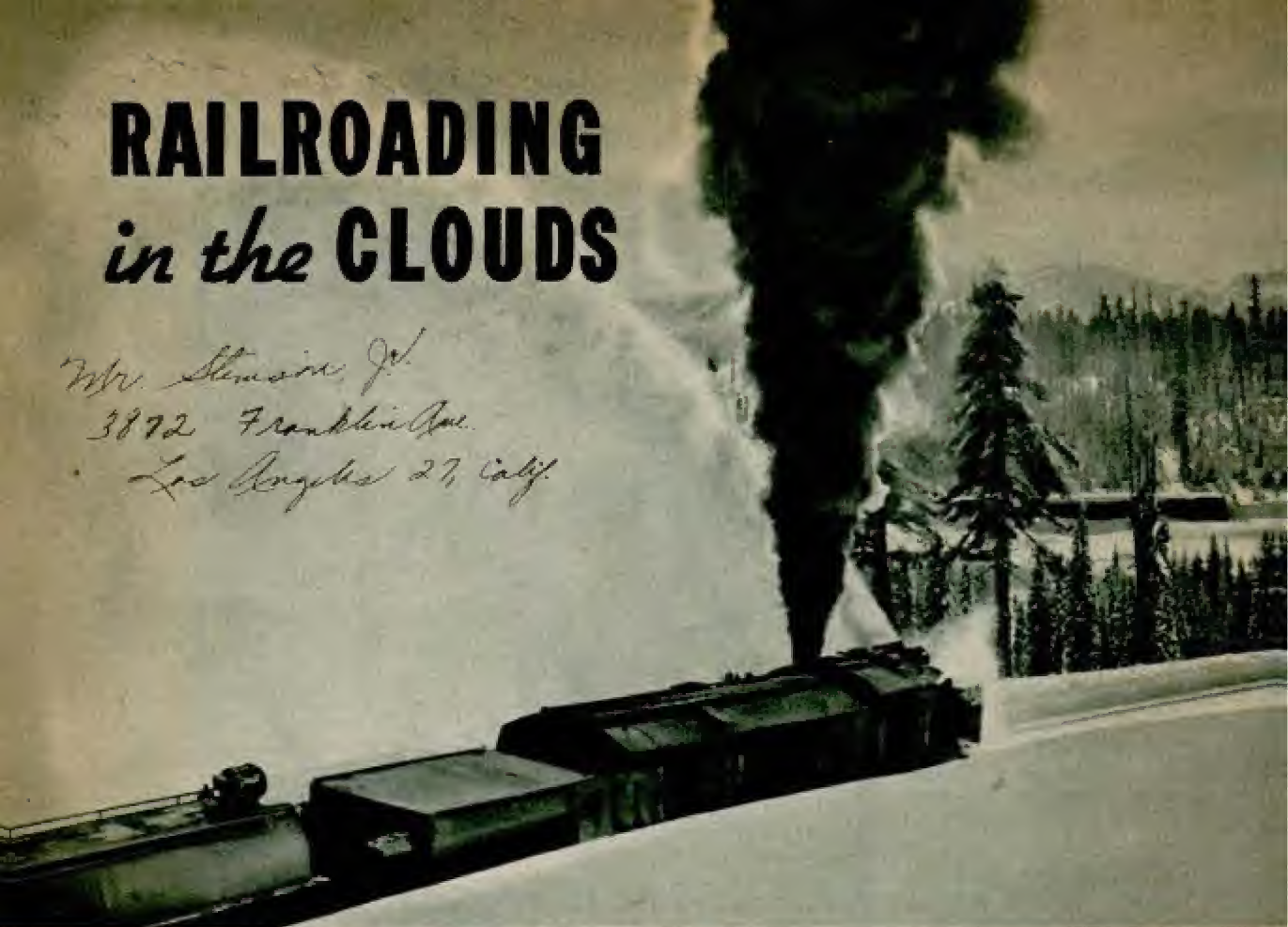
FEBRUARY, 1944

*Owens-Corning Fiberglas Corp.  
Nicholas Paver  
Toledo, Ohio*



# RAILROADING *in the* CLOUDS

*Mr. Stimson, Jr.  
3872 Franklin Ave.  
Los Angeles 27, Calif.*



A rotary plow sends a stream of snow skyward as it fights to clear the tracks over a western mountain range

By Thomas E. Stimson, Jr.

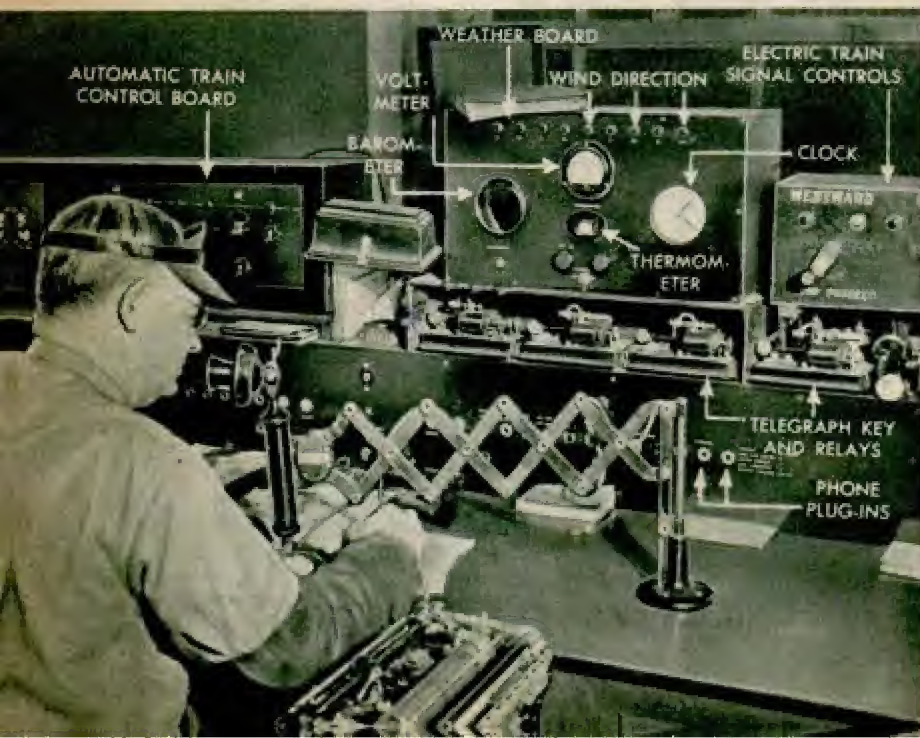
71591

THERE are more special trains crawling up over the Mountain these days than there are trains on regular runs. Troop trains, ammunition trains, trains hauling the thousand and one implements of war are crowding each other to the extent of

2,500 freight and passenger cars per day, on the Mountain.

The Mountain is the name railroad men have for the Sierra Nevada range in California. To cross it, Southern Pacific's double track line climbs from 35 feet above sea level at Sacramento to 7,000 feet at the summit and then slides down to 4,500 feet at Reno on the eastern side. It is one of the main links between the west coast and the rest of the country, and a vital artery of our defense system. Soldiers guard its vital structures.

It takes a crack crew of railroad veterans to keep traffic moving over its grades, for the Mountain is a fighter. Gales of great intensity sweep through its passes in the winter. Seasonal snowfall has reached



Busy operator at Southern Pacific's Norden, Calif., mountain station is also a weather man



almost 800 inches, and as much as 23 feet of snow may lie on the level ground at one time. All the way back to the gold rush days of '49, the Mountain's history is full of episodes of man's campaign to subjugate it. In early railroad days an attempt was made to keep the tracks clear of snow by using an immense wooden snow plow, with eight of the best locomotives of the day coupled on behind to buck the drifts. It didn't work, for the snow packed up in front of the plow and stalled the locomotives. Today the railroad crews have the upper hand over their adversary but they still treat the Mountain with respect.

Up on the summit at Norden they built their station and switching system inside a giant snow shed. It was simpler to roof in the area than it was to battle snow all winter long. The 6 big snow plows on the line have enough work to do as it is.

Yet the men can't relax when the last snow melts from the right-of-way in the spring. The fire season begins when the storm season ends. Under the roof at Norden stands a special fire train all summer long, steam up in its boiler, water cars coupled on behind, and with a full crew at stand by. There are 8 miles of snow sheds



Southern Pacific trouble shooters repair lines after a Sierra snowstorm

and tunnels that must be defended in case of forest fire, as well as trestles and other structures. These snowsheds are protected in dry season by manually operated sprinklers. Another fire train, always ready to move at a moment's notice, is stationed at Truckee on the eastern slope. The railroad likes to fight a fire from both sides at once. Many locomotives are equipped to sprinkle water on ties and bridges.

From Norden, east and west, the railroad has its own alarm system. Track walkers

The Diesel-electric "City of San Francisco" has little trouble climbing the "hump" of the Sierra Nevada







The running gear of a big mountain locomotive gets a "hot oil shampoo"

or soldiers who find trouble on the line can go to the nearest alarm box and make their report simply by turning a telephone-type dial to a position marked "fire" or "slide" or other trouble. The alarm rings automatically at Norden, showing the kind of emergency and its location and making it possible to rush the right kind of equipment out at once.

The Southern Pacific maintains its own weather station at Norden and another at Sacramento. Barometric pressure, temperature, and the force and direction of the wind are necessary information for operating trains over the Sierra. The two points are linked by a stormproof communication

system. A direct telephone circuit employing loud speakers instead of earphones is ordinarily used, with Morse available if the phones go out. For emergencies an induction type of communication system that feeds back and forth across land wires irrespective of breaks in their strands is available. Finally, two-way short wave radio, battery operated, is ready for use if all other means of communication fail.

This elaborate setup is mainly for the benefit of the Sacramento dispatcher. He must know, hour by hour, what the weather is on top. The dispatcher

knows that the men on the Mountain will keep the tracks open for him. As long as he knows what kind of weather his train crews will encounter, the dispatcher can call out the amounts of power needed to keep traffic on the move.

His power comes in big packages. The standard mountain engine of the Southern Pacific is a giant cab-in-front articulated consolidation locomotive of 6,000 horsepower. These engines weigh 657,000 pounds without the tender and have two eight-wheeled sets of drivers that feed from one great boiler. Even these giants take a beating in mountain service. Within a year their thick steel tires may be worn down so badly they must be replaced.

A cab-in-front locomotive looks strange the first time you see one. It is built that way to put the engine crew in front, ahead of the choking gases that are expelled from the stack at the other end of the engine. Being in front helps the crew to see around the corners on the curving mountain grades. They don't need to squint along the engine's long boiler to watch the track and the block signals.

To the dispatchers and crews, these engines haul M's instead of such assorted things as guns and

A railway rotary plow bites into a fresh snowbank on the line







A giant cab-in-front engine, built to "see around" mountain curves, hauls a long freight up the grade between Reno and San Francisco on the Southern Pacific, one of the busiest arteries

apricots. An M is a handy unit for finding the weight of a train. Each M represents half a ton of weight behind the engine. The M's tell a dispatcher what power he must use to move the train.

When the barometer falls at Sacramento and the report comes down from Norden that the wind is swinging to the north, the whole division tightens up in preparation for the coming storm. A heavy east-bound freight may have been given two big AC locomotives to serve as helpers to its regular engine but not even this amount of power might keep the train moving uphill during the storm. The dispatcher breaks the train down to a shorter length, reducing the M's that the locomotives must move.

The sun may continue to shine in Sacramento but by now the snow flangers are moving out from their sidings in the mountains to clear the rails. If the storm in-

creases its intensity, the big rotaries will begin to churn along the tracks, picking the snow up with their blades and tossing it through the air to one side. If the storm builds up into a raging blizzard it may be necessary at Colfax or Norden or Truckee

(Continued to page 150)



Operating interlocking system at Norden, built in a snowshed



*Hedge  
Linson  
71809*

# **"GUN-PACKING" GIRLS PUT KICK IN MUSTANG**

*Remnants Dept.  
of North American  
Aviation*



When the .50-caliber machine guns destined for turrets of Mitchell bombers and mounts of Mustang fighters arrive at North American's plane plant, "gun girls" take them from their packing of heavy grease (above), clean them, reassemble their 219 different parts, check them for timing, charging and mounting, and even test-fire them. To test twin-gun turret's ejectors (left) a belt of dummy bullets is fed through. Turret below checks o.k.



"Gun girl" below fires 10 rounds to test gun for a Mustang; switch she holds fires gun electrically



*Left: 71809*





William B. Winter  
Newton, Mass.

N 775

## Two-Story Dehydrator Dries Food in Minute

By utilizing a veritable cyclone of wind within a giant dehydrator, food can be dried, ready for packaging, in 60 seconds or less. Food is first placed in a huge, funnel-shaped tank, where it strikes the air, whirling at a velocity of a mile a minute. In this vortex it is whirled, then dropped down a pipe to a joint, where it meets warm air from a gas furnace, which impels it up the other section of pipe, forming the V of the joint. In a second funnel-shaped tank it is again whirled, after which it drops down to a bagging conveyor, completely dehydrated. The installation utilizing this principle is taller than a two-story building.

Food is dehydrated, ready for packaging, in one minute in this two-story drier, using air circulating at speeds of a mile a minute. Food drops down from one tank, then is whirled, dry, up in the other



## Fire Jeep With 375-Foot Hose Pumps Its Own Water

N 741



Fire-fighting is the newest task for the jeep, the armed forces' omnipresent blitz buggy. At the Willys-Overland Motors plant, the jeep performs many of the duties of a full-sized fire wagon. Built for quick dispatch to factory areas that cannot be reached by larger apparatus, it is equipped with a 500-gallon-per-minute pump, and carries 375 feet of fire hose.

Jeep equipped with 500-gallon-a-minute pump is used for fire-fighting at plant of Willys-Overland



7683

# SLEIGHT-OF-HAND MEN



Men of Engineer Aviation Camouflage Battalion are stationed at vantage points to prevent attack on airfield under construction



building or capturing airfields by the hundreds. Every day swarms of planes are sitting down on newly acquired runways.

But nature, like the enemy, seldom goes out of its way to provide us with a natural airfield. Runways must be leveled, trees and shrubs cleared away, and

At the order "Clear the field!" dummy tree and shrub (left) are moved so planes can land. Below, sentry in camouflaged suit



**E**VER hear of an Engineer Aviation Camouflage Battalion? Probably not, for until recently its activities were cloaked in such secrecy that the mere fact of its existence was unknown. But now something of the story may be told. At an air field in Arizona, such a battalion is in training and here officers and men are learning that the Engineer Aviation Camoufleurs' motto: "Build, Conceal, Maintain and Defend" is not just words out of the dictionary.

Today, from Italy to Tasmania, Uncle Sam is

W. Robert Clark  
540 Pkwy Bldg  
Chandler, Calif



# of the AIR FORCE



Strafing planes give camoufleurs realistic dress rehearsal, above. At right, how plant is fixed to "Christmas tree base" to camouflage field

rocks removed before even a slow liaison plane can land.

Down in Arizona, men in the Engineer Aviation Camouflage Battalion are learning how to do all this and more. They learn how to move themselves and all their equipment into some remote and wild region and within a few hours construct a landing field.

But this is only the beginning. Once built, the field must be camouflaged to conceal its position from enemy reconnaissance planes. And to do this it must be constantly maintained. For the freshly cut limbs of trees used for camouflage soon wither and must be replaced with fresh foliage. And last, but not least, these Engineers must be prepared to defend their handiwork from enemy patrols and raiding parties.

The necessary knowledge and experience to do these jobs at tip-top efficiency do not come from reading books and poring over drafting tables alone—but rather as the result of long and hard days in the field, training under simulated battle conditions.

But one must not draw the conclusion that an Engineer Aviation Camouflage Battalion is composed of men with weak minds and strong backs—for almost every man in the outfit, officers and enlisted men, has been a specialist in civilian life. And many are men with national reputations—artists, visual education instructors, sculptors, architectural draftsmen and all sorts of technicians.

Once assigned to the Engineers, these men can put their talents to work almost immediately, although like all soldiers they must take their basic training.







U. S. Army Air Force photo

Decoy airfield built as lure near real field has plane and antiaircraft emplacement purposely showing from air

The ingenuity displayed by these camouflagers would put to shame the resourcefulness of a movie property man. For unlike the proverbial stage magician who can only produce a rabbit out of a hat, the Engineer camouflage group, if the need arose, could produce a hat out of a rabbit!

The men perform operational problems of the type they will meet in a war zone, for the adage, "Practice makes perfect," applies as well within the army as out of it.

Before a unit like this goes into action on a training operation, experienced map-makers study aerial photographs from

which ground elevations can be closely estimated. A possible site for an advanced combat operation airfield is chosen and a reconnaissance plane is sent out to look the spot over more closely.

If the reconnaissance report is favorable, the operations officer of the battalion gets on the phone and calls the air intelligence officer of a friendly "enemy" who is located at a fighter training base seventy-five miles away.

"We're moving north, northeast tonight," he says, "And by tomorrow we'll have an airfield built somewhere near the map co-

Camouflagers improvise a dummy plane of palm fronds; other dummies are made of burlap, wire and feathers

U. S. Army Engineers photo







Two-by-fours surmounted by tin cans to prevent ripping support "shrimp net" camouflaging one of unit's trucks

ordinates of S-63—think you can find us?"

"A cinch," says air intelligence. "Better protect your men, for we'll strafe the field with live tracers before we land."

"If you can find it!" taunts the operations officer as he hangs up.

That afternoon a truck convoy is readied to move the men and equipment over the country by night. And often this means traveling over terrain where the nearest road is 15 or 20 miles away.

Just at sundown, the long convoy snakes off the main highway and heads north, northeast into the gathering darkness.

For the next several hours the trucks bounce and slide over rocks and gullies, stopping now and then while men pile out with pick and shovel to widen the road or fill in some bad spot.

It is two o'clock in the morning by the time they arrive at map coordinates S-63—50 miles from anywhere and in the most desolate and forbidding spot to be found on the Arizona desert.

"I've been through North Africa," says the operations officer wiping his brow. "And the terrain and tempera-

ture there are rugged—but nothing to compare with this!"

All around are giant saguaro cactus, prickly pear, mesquite and rattlesnakes. That an airfield could be carved out of this wilderness is almost unbelievable.

But within half an hour all trucks and equipment, including small bulldozers for leveling and grading, are dispersed and camouflaged. This is done in pitch darkness, for the slightest gleam of light might reveal the position to the "enemy."

For camouflaging, each truck carries its own "shrimp net," a large, closely woven piece of material similar to standard fish-netting, but dyed a color which blends in with that of the earth. When thrown over a vehicle and supported at odd angles by

Vital to deception is foliage thrown haphazardly over "shrimp net," as shown here







Well camouflaged truck and trailer; note how net merges with mountain in background, making outline vague

two-by-fours, this net completely covers the truck from view—sides and top. And when dirt is scattered on the net's edge along the ground to "feather" the outline the effect from the air is that of just another small knoll.

In a few hours, more installations of all sorts are readied. A headquarters and operations section containing two-way radio equipment is set up under a "flat-top"—the army's term for a camouflage net of larger weave "garnished" with burlap strips and supported by a light framework to provide headroom.

Soon a complete field hospital is set up under another flat-top—furnished with everything from operating tables to eyeball needles.

In the meantime other men are out in the area which is to be made into the landing strip. Trees and bushes are cut down and their position carefully noted. As one group cuts the trees, another is busy nailing sturdy crosspieces to the bottom of the trunks. These resemble the familiar Christmas tree support and are attached to cactus plants as well as to trees and shrubs. In no time at all each tree and bush is back in the same spot it previously occupied.

The purpose of all this work of cutting and replacing is obvious when it becomes light. For shortly after sunup, "enemy" reconnaissance planes are sweeping the area, taking aerial photographs. Thirty minutes later these pictures have been developed and are being studied by the

air intelligence officer at the fighter base.

As photograph after photograph comes in, he attempts to find changes in the location of trees and shrubs—which would be a dead giveaway of the location of the airfield. But the camoufleurs are too smart for this—they, too, know tricks that will fool the camera.

During all this activity, yet another group is a mile away building a second airfield—the decoy. Here a space the size of a landing strip is carefully dragged over by a truck hauling several logs tied together at the rear. Some large trees are cut down and haphazardly thrown to one side. Also a couple of flat-tops are put up—but not well concealed. And a dummy anti-aircraft gun is constructed out of burlap, as well as a fake truck, also poorly camouflaged.

Shortly after this is completed, everything is in readiness to receive the "enemy" planes, and sure enough it isn't long until out of the blue comes the high-pitched "Zzzzz-z-z-z!" of fighters. There are three of them and they zoom down from the clouds spitting flame. Straight for the decoy field they dive, tracers streaming earthward.

Up they go and then down again to buzz the worthless target while the men of the camouflage battalion squat in their foxholes and smile with grim satisfaction.

"I knew they couldn't find us," says the operations officer. "But look at 'em go! I'd like to see their faces when we tell them they've missed."



As if to answer his words, the loudspeaker in the operations section crackles and the flight leader above says, "Well, how about it? Give up! Get those fake trees out of the way and we'll come in!"

The operations officer lifts his mike. "You mean you want to land on that field you strafed?"

"Yeah," comes the answer. "Hope you're better at building a landing strip than you are at concealing it."

"You try to land on that spot you've been shooting at," snorts the operations officer, "and you'll crack up! That's just a decoy field . . . Look around some more!"

The flyers fan out in ever-increasing circles to begin a systematic search for the hidden field. Although the three planes fly over the camouflaged strip time and again, the pilots don't see it.

Finally, at a command from the operations officer, the men rush out on the runway and remove over 100 trees and plants. And within three minutes the desert is transformed—revealing from the air a landing strip 200 feet wide and 3,500 feet long.

Shortly afterward the planes land. And by the time the last pilot taxis to the end of the field, the dummy trees and shrubs are back in their former position and from the air the field looks like the surrounding countryside.

"Looks like the drinks are on us," says the flight leader. If you can fool us—even when we know your approximate location—the enemy wouldn't have a chance!"

"He never did have!" says the operations officer with a smile.

## Vinegar Is Milk By-Product Three Times Removed

By using the by-product of a by-product, chemists are turning milk into vinegar. First by-product is the whey residue after cheese is made from milk. Cheese whey once was wasted, but recently has been made into a feed concentrate for hogs and poultry. Residue of that process was a low-alcohol by-product, and by distilling this to concentrate the alcohol, denaturing it, and adding nutrients for the bacteria, the chemists finally produced vinegar.

## U. S. Army Rifle Hurls Grenade With Launcher Attachment



Preparing to launch grenade from converted .30 caliber rifle

High powered rifle grenades are propelled by ordinary U. S. Army .30-caliber rifles equipped with launching apparatus. This weapon is used against pillboxes and similar defenses. It covers a hitherto neglected range—the interval between the distance a soldier can throw a hand grenade and the range covered by a mortar or the famous bazooka.

## Pulverizer Levels and Packs Uneven Soil In a Single Operation

Made in flexible segments to ride over uneven surfaces, a new farming tool levels, pulverizes and packs the soil in one operation. It is especially designed to prepare seed beds, orchards and vineyards. Ordinary plowing, disking and harrowing leaves the soil with numerous air pockets that tend to dry the soil; the new unit firms the subsurface, closing the air pockets to help retain moisture and promote better plant growth. In addition, it pulverizes the soil to the depth of several inches.



Pulverizer firms subsurface to help retain moisture of the soil

FEBRUARY, 1944

Consolidated Products Co.  
Danville, Del.

D. G. Schmeiser Co.  
Tucson, Calif.



# CHEMICAL MAGIC



There's a world of magic in common chemicals. Above, blushing photo: Spray with water, paint cheeks with phenolphthalein solution. Finger is moistened with household ammonia and points at picture. Fumes cause "blushing." Right, glass rod lights a candle. Carefully mix powdered sugar with powdered potassium chlorate, pile it on wick. Sulfuric acid on rod causes flame



To prepare chemical garden below sprinkle quarter-inch of sand on bottom of jar, fill remainder of jar with equal parts of water and sodium silicate—"water glass." "Seeds" are salts of heavy metals, i.e., copper, nickel, ferrous or zinc sulfate; cobalt or manganese chloride, all different colors. Crystals "shoots" begin to grow within a few seconds; blossoms in hours





Three Lions  
551 Fifth Ave.  
N. Y. 17 N. Y.

7/628

Right, how smoke appears in "empty" glasses. Show two tumblers, apparently empty. Then put them quickly mouth to mouth and cover them with a cloth. Next, you remove the cloth, and, amazingly, the tumblers are smoke-filled! To prepare for this trick, rinse one glass with strong ammonia, the other with strong hydrochloric acid. When apart, they appear empty; brought together, fumes combine to form white smoke of ammonium chloride. Below, moth balls with magic motion. Add a little vinegar to a glass of water, then pour in half a teaspoonful of baking soda. When effervescence ends, drop in a few moth balls. Carbon dioxide gas forms in bubbles on surface of balls, lifts them to top. Gas dissipates, they fall



Handkerchief at right is "unburnable." Borrow the handkerchief from someone in your audience, and dip it in a solution, half water and half denatured alcohol. When you light it the alcohol will burn—but not the handkerchief. Reason is the water keeps cloth below burning temperature. You return the handkerchief, unharmed



To make the disappearing ink as shown at right, dilute sulfuric acid with water. Be careful, always add the acid to the water, not the water to the acid. Writing done in this "ink" is ordinarily invisible, but warming the paper makes the otherwise unseen message show up as vividly as in drawing pictured here

FEBRUARY, 1944

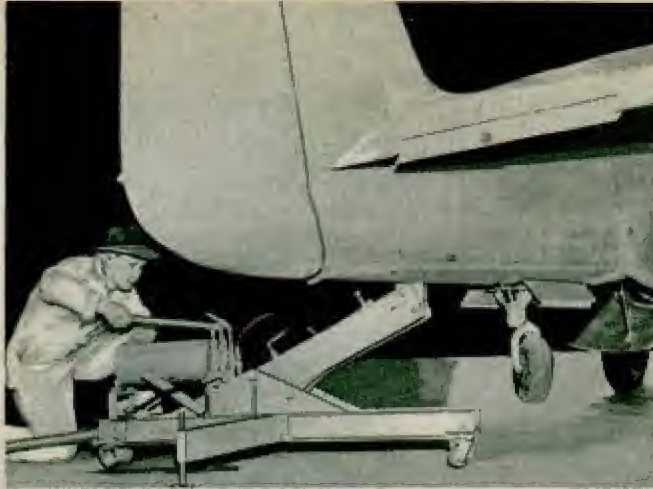




*Malabar Machine Co.  
5722 Santa Fe Ave.  
Los Angeles, Calif.*

*N 744*

## Plane Jacked to Flight Level for Instrument Test



One person may readily operate a hydraulic jack designed to raise the tail of an airplane until the craft is in the position of level flight. When it is so raised, instruments may be checked in proper relation to their position when in normal use. Such checks may even eliminate the need for an instrument-checking flight. The triple-action jack has a maximum lift of 52 inches and, as the jack rises, fins extend to form a tripod base for greater stability.

One-man jack lifts plane to level of flight for check of its instruments

*N 752*

## "Blinkers" for Jeep Windshield Eliminate Telltale Glare

*Winds, Ohio*

Canvas envelopes that fit over the windshields of jeeps used as scout cars eliminate the glare of moonlight or enemy searchlights. The "blitz blinkers," designed by engineers at Willys-Overland Motors, fit over the windshield as it rests in folding position on the jeep's hood. It is quickly adjusted. In the past, scouts had to use various makeshifts to cover the windshield to stop reflection which would reveal troop movements to the enemy.



Fitting "blitz blinkers" over windshield of jeep helps fool the enemy

*N 784*

## "Cradle" Brake Tester for Airplane Simulates Friction of Pavement

Revolving rollers which are constructed a tire on concrete are used to test the brakes of aircraft. Dials beside each roller register the force required to turn the wheels after the brakes are applied. The testing machine is used to reveal landing gear strut distortion and to detect tire weakness, as well as to determine stopping distances and for equalizing brakes.

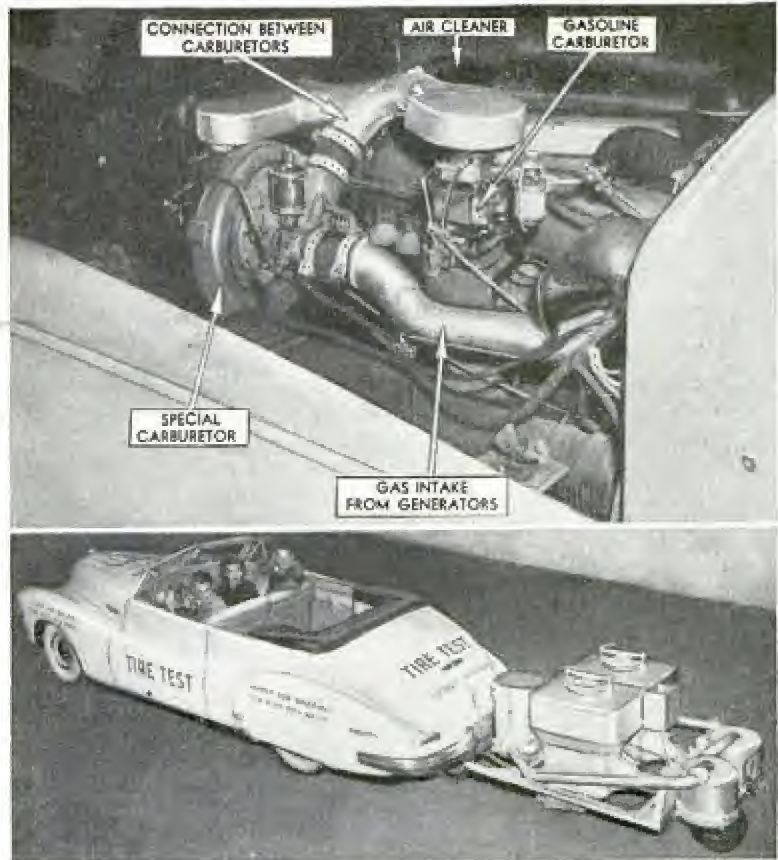


Dials beside revolving rollers on tester show force required to turn wheels with the brake on



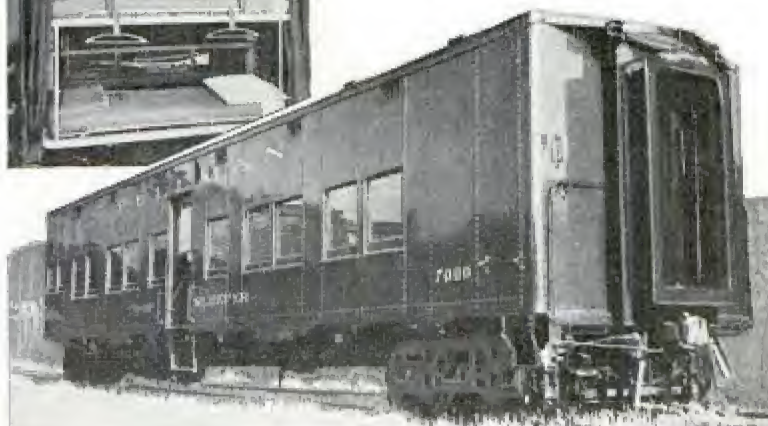
*Chicago Tribune*  
*Hal Frank, Tribune Tower*  
*Chicago, Ill.* 71653  
**Charcoal-Burning Auto Has "Alcohol" Tires**

Neither gasoline nor rubber is required to operate a test automobile that burns charcoal gas and rolls on tires made from alcohol derived from waste at pulpwood mills. The gasless auto, developed by a Chicago newspaper as a research project and similar to many now being used in Europe, has a one-wheel trailer that carries the charcoal-burning apparatus. Two gas generators on the trailer convert the charcoal to carbon monoxide gas. Hydrogen is also generated by injecting hot water into the fire box. The mixed gases pass through a series of filters before reaching a special carburetor. A fan in the carburetor sucks the gas from the generators, mixes it with air and blows the mixture into the cylinders. The synthetic rubber tires are made from alcohol from sulphite liquor.



Closeup (top) of carburetor hookup for burning carbon monoxide gas obtained from charcoal. Trailer unit (bottom) contains two gas generators

71677  
**Triple-Deck Sleeper for Army Has Extra Door at Center**



Built specially for transporting troops, this all-steel Pullman car may reduce travel rates after the war. View at top shows berth arrangement

Triple-deck sleeping cars, a new type of Pullman car for transporting troops, provide accommodations for 30 men on each car. Although of all steel construction, the cost is said to be only a fraction of a standard Pullman car. The top berth remains fixed during the day, and the middle berth becomes the back of a seat which is formed by the lower berth. It seats three persons. The sections are grouped on one side of the car with the aisle running along the side. In addition to end doors, the troop sleeper has wide doors on each side of the center to facilitate loading. This gives the cars the appearance of European passenger coaches. The cars are designed for full interchangeability with all other cars, and are equipped with high speed swing motion trucks for comfort. They are similar to a postwar sleeper planned by the Pullman company.



# STEPPING STONES to TOKYO



Island bases are necessary for offensives against Japan. Amphibious forces above train for invasion. Left, up to the waist in work on ramps for seaplanes

what it would take to get the Yanks equipped for that fight; her decks, too, were piled with cargo.

But she swung there at anchor for 75 days before she could be unloaded!

It had taken only about a month for her run to the South Pacific; yet with her almost 11 weeks of idleness, and her elapsed

time on the return trip, she was more than a third of a year in making one round trip to the fighting front.

There was no one to blame—except Tojo. Her story simply points up one thing that sailing men know well and that the public tends to forget: That action at sea requires ships, men—and bases.

The men were there, plenty of them. The ships came bursting from their ports, deep-laden with the stuff of war. But within that whole area of the South Pacific, virtually no harbor had ever before seen any vessel other than an inter-island trader.

Not one harbor was able to accommodate the warships, auxiliaries, transports, cargo vessels, and all the rest of a Neptune's brood that had to be visited upon the isles.

In his first, relentless surge to the south, the enemy had won ports that generations

**S**HE wasn't an ordinary Liberty Ship. In record time she had been hammered, riveted and welded together and launched at a West Coast shipyard. When her fitting out was accomplished, her cargo was waiting for her, so that what only days before had been an incoherent mass of steel, wood and machinery was now a sturdy cargo vessel, afloat, laden, and outward bound on a voyage of vengeance.

Within a few weeks from the day her keel was laid she had let down her anchor in the harbor of a South Pacific island, where the might of the United States was drawing up into a mailed fist to deliver a blow to the Jap jaw. Her hold was jammed with



of Allied tradesmen had labored to make efficient for warships and merchantmen—Hong Kong, Manila, Davao, Singapore, Surabaya. We got the leavings, and they weren't much.

But the offspring of Americans who had chased the old frontier to where it ended on our West Coast proved that pioneering was not a lost art, and that they could take on and conquer wildernesses even thousands of miles overseas. The fact that within weeks of that heart-rending incident of the record-breaking Liberty Ship, the same port where she lay idle had

boosted its cargo-handling capacity many times over shows the stupendous achievement of America's fighting builders.

This port, and others that once resembled only a beachcomber's version of Paradise, have become bustling harbors in the Yankee tradition, ports that bid fair to rival some of the big and busy seacoast towns on the American continent.

A base is many things, but above all it is a home away from home for America's fighting men and their fighting equipment. It is a place for ship-repair machinery, for



U. S. Navy photo  
Army, Navy and Marines co-operate to win islands and transform them into bases. Bringing ashore scout plane on ramp nicknamed "Brooklyn Bridge"

fuel dumps, ammunition dumps, airplane workshops; for garages for tanks, jeeps, trucks, bulldozers, and the other powered implements of war.

A base means warehouses, to store replacement parts for every variety of land, sea, and airgoing machine; cold-storage houses for tons of food; docks and wharves to speed the unloading of ships; barracks, hospitals and recreational units for thousands of men. It must, in brief, be a military metropolis, and the men so intent on building it know the enemy is just as de-

Jungle lumberjacks are members of famed Navy Seabees, feeding sawmill on Guadalcanal







Official Signal Corps photo

Officers of the Amphibian Command watch the laying of a mat roadway to carry heavy vehicles across a beach

terminated to blast it into useless rubble.

Without advanced bases, neither ships nor planes nor men can hope to sustain battle. One properly outfitted base may be equivalent to an entire naval task force, because, operating from it, one force may be able to fall back, refuel and refit, and re-enter the fight before a force operating from a more remote station could even reach the scene.

In effect, mere distance away from home limits the size of land, sea, and air forces.

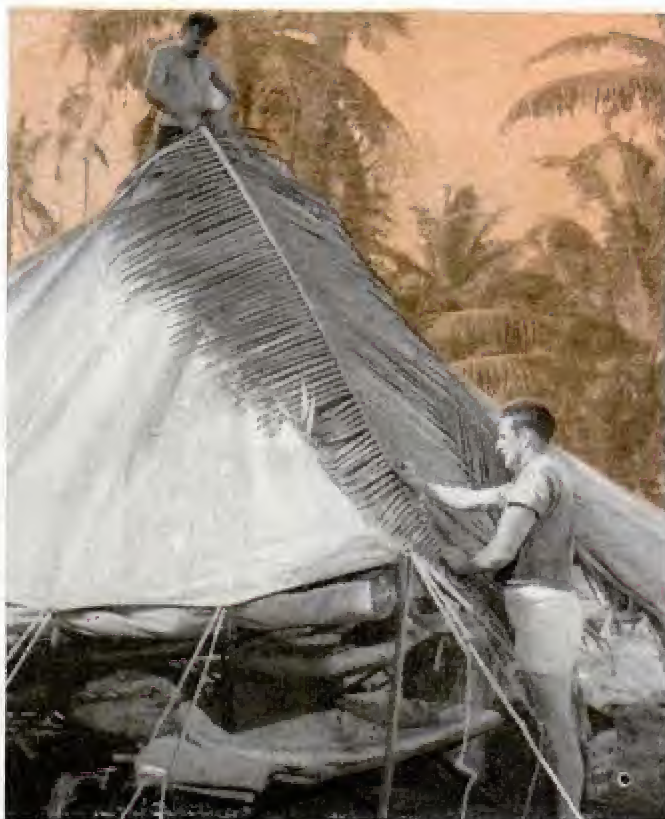
"When we shoot down a plane the Jap replaces it in a few days," said Lt. Gen. George C. Kenney at one juncture in the battle for New Guinea. "When he shoots down one of ours, the replacement has to come a long way and it takes time."

The Jap, at that time, was reported to have an assembly factory for Zeros right in the Solomon Islands. The Jap had been preparing for war for 20 years.

It takes at least eight tons of shipping and transport to carry one man overseas, and a ton a month thereafter to keep him fighting. Multiply the number of men overseas by these tonnage figures, and you get an idea of not only the number of ships required, but also of the number of bases.

For the men and goods carried by the ships must be put down somewhere hard by the fighting front.

What are we building on these island stepping stones? Here is one example. At Base X in the South Pacific has been erected a repair plant for airplanes. This, with



Palm fronds are ideal camouflage material



other island facilities, will enable American mechanics to complete repair jobs that may be needed.

That means more American planes over Jap targets more of the time. Formerly the machines and men able to do this work didn't exist closer than Pearl Harbor, and some of the work had to go all the way back to the United States.

Though replacements are always provided, the danger was that if enough repairs were needed at the same time, planes simply couldn't fly. Facilities let men at the base do anything to a plane short of actually rebuilding one.

They can, for instance, give expert service on the spot to delicate and complicated mechanisms. And, being familiar with battle requirements, they learn quickly how to repair landing gears strained by operations from rough new fields, and learn how to prevent damage to stored engines and parts caused by excessive humidity.

As with planes, so with ships. Ideally, a naval base should be able to reproduce anything lost or damaged aboard any type of vessel, from an officer's binoculars to a 16-inch gun. Few such first-class bases exist outside of home waters, and it is not to be expected that in relatively few months even the storied Seabees, the Navy's famed Construction Battalions would be able to convert a remote, scantily populated island into another Pearl Harbor.

But there are on-the-spot repairs that



Soldiers and sailors work side by side to unload jeep from a transport

must and can be made. The outposts must be equipped to take over a bombed or torpedoed vessel and, if not mend it completely, at least so repair it that it can make its way to where it can be rebuilt.

Some of the success of the rapid-fire building program may be laid to standardization and prefabrication. Fuel and water storage tanks, for instance, are shipped so that they require only assembling. Quick-drying cement provides foundations for guns, buildings and docks. Landing strips form runways that can be "laid in a day." The ubiquitous pontoon, a big metal cube, can be used, in groups, to form landing barges, piers, wharves, or bridges.

The more war becomes mechanized, the more necessary become well-equipped advanced bases. Machines, if kept in fighting trim, require thousands of spare parts. For

Tank rolls ashore down steel ramp from landing craft the Marines call a "crocodile boat"







Seabees erect Quonset hut as shelter against the persistent jungle rain

example, the Fisher Body Division of General Motors, building the M-4 tank, reports that a "set" of spare parts for the tanks—enough to service 100 tanks in the field for one year—fills 16 freight cars and weighs more than a million pounds.

This mammoth shipment gives a backlog of efficiency to only one weapon, and a land weapon at that—a featherweight compared with any sort of combat vessel. What it takes to keep ships at sea can be readily imagined.

The Seabees, a cross-section of all the skills known to the world's most industrialized nation, have proved themselves veritable Robinson Crusoes of ingenuity in converting barren islands into ports with all the maritime comforts of home.

But the job isn't ended. Even if—as air-

6,000-mile front from the Central Pacific to Burma. In and around the Coral Sea, though, the Yanks breached the wall.

To maintain the pressure against the Jap, though, that wall must be converted into our own bastion. That is where the South Pacific islands acquire an importance out of all proportion to their size.

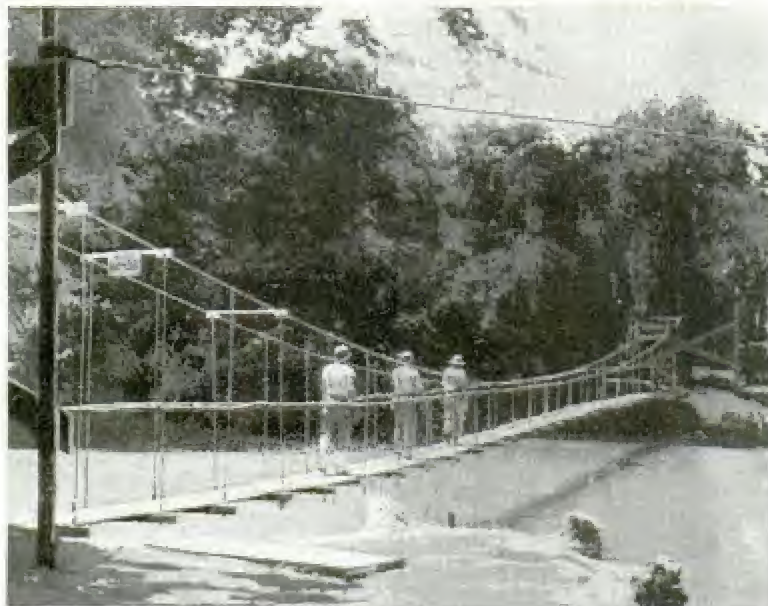
Almost a century ago a man who came to know Japan as intimately as any American, and was a true prophet of the Jap intentions, said of these blissful, palm-grown spots of land:

"The occupation of the principal ports of those islands, for the accommodation of our ships of war, and for the safe resort of merchant vessels of whatever other nation, would be a measure not only justified by the strictest rules of moral law but by the laws of stern necessity."

He was Commodore Matthew C. Perry, the man who "opened" Japan to world trade in 1853. It took the attack at Pearl Harbor to transform American conception of the islands from romantic movie settings to foot-holds on a lifeline.

Perry's advice still rings true. Though we lost some of the islands Perry most wanted us to have, much closer to Tokyo, we have snatched from initial defeat the Pacific stepping stones that mark the way to final victory.

Narrow but sturdy footbridge of the Seabees spans jungle stream





## "Telescope" Spray Tower Holds Hose in Tube

Top branches of orchard trees can be sprayed with ease with a cable-operated extension tower mounted on a truck. It is constructed of three telescoping sections of steel tubing, with a platform that stands 26 feet above the ground. A handy feature of the spray tower is that the hose is housed within the tube, eliminating the usual trouble with branches where trees are close-grown. The tower is operated by a worm reduction gear hoist connected to the power take-off of the truck engine. The reduction gear acts as an automatic safety brake.

With "air" and "ground" crew operating spraying equipment, fruit trees are sprayed in a jiffy. The extension tower is made of three telescoping sections, adjustable to various levels. When fully extended, platform is 26 feet above ground

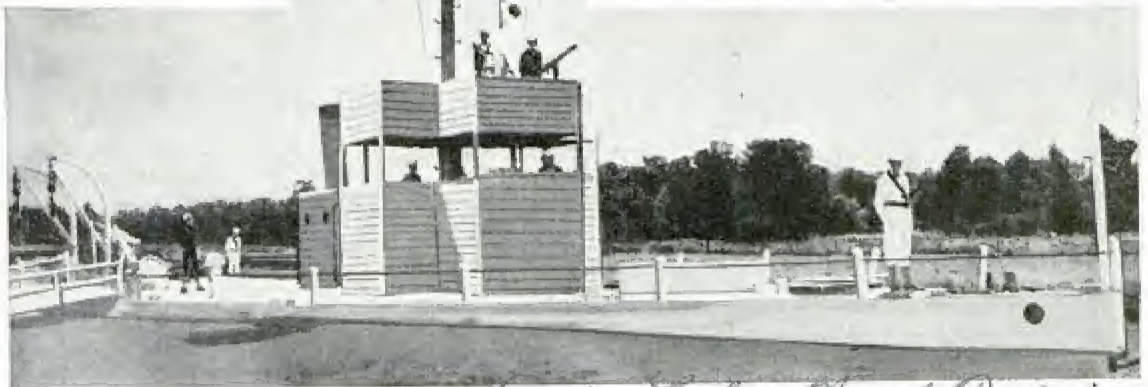


## Gunboat "Launched" in Field Prepares Recruits for Sea

Sailors are introduced to such actual duties as they will encounter aboard vessels at sea aboard the U.S.S. Dahlgren, a mock gunboat, "launched" in a cornfield at a Naval training station



With a 50-foot beam and a 180-foot keel, she should be a respectable vessel, but the U.S.S. Dahlgren, "commissioned" at a naval training station, will never put to sea. For instead of reposing majestically on the water, she lies forever stranded in a one-time cornfield. The mock craft was built for training recruits, who stand watches aboard, take turns at the wheel, learn how to use signal flags, and handle lifeboats.





# DAREDEVILS *of the* DEEP



Student divers getting ready to go down into Hudson river from Pier 88 alongside the *Normandie*. Each diver has two helpers

Official U. S. Navy photos



THERE are fewer than a thousand of them scattered around the embattled globe in squads of half a dozen or more, wherever tides run swift and currents are dangerous. Yet man for man the U. S. Navy can boast of no more important personnel than these ultra-modern, trouble-shooting salvage divers trained at the Navy's newest school on Pier 88 in New York City.

Instead of trigger-quick Japs, they encounter marauding barracudas, but not a man has lost a war of nerves with one of these fish. They chase sharks with a spurt of flame from an underwater metal-cutting torch, or a rap on the nose with a steel wrench. They face peril very much on their own, alone in the depths.

Development of these quick-witted, tough-bodied World War II salvage divers is somewhat of an accident. Between wars, the Navy relied largely on civilian

Even after a diving test 40 feet down in the Hudson, student must undergo compression room test, simulating great depths



divers for ordinary salvage work, using Navy men principally for submarine rescues and submarine salvage. The sinkings at Pearl Harbor demanded the services of hundreds of under-water workers. The capsizing of the *Normandie*, or *Lafayette*, in New York City called for scores more. Thousands of salvage tasks multiplied around the world as our vessels slugged it out with enemy ships or the raging elements.

An enterprising Navy officer asked that 65 men and officers be assigned for training, obtaining school space on Pier 88, not far from where the *Normandie* was being refloated. Arguing that the trainees could not only learn diving on the *Normandie*, but could be of considerable help to the over-worked divers already on the job, he got not only his 65 men, but nearly 150 more volunteers.



When student has undergone all the tests near to the pier he is taken for dive in swirling tides

They proved so valuable that the roster of the school was boosted past 500, and Pier 88 became one of the greatest diver training centers in the world.

The divers' services are priceless because they have been taught to think for themselves while under the water. No school could solve in advance the thousands of undersea salvage problems peculiar to this war which the graduates have met.

In distant seas these youths have learned that the tropic sun beating down on a diver's air tanks at the surface can virtually give a man 100 feet below heat prostration. They have found that arctic atmosphere, pumped into his helmet, will freeze shut his vital air valve even when the diver is working in comparatively



Navy's diving school operates day and night. Left, seven student divers going to "night class"





"Tooker patch" for sealing portholes is demonstrated to students, after which they will put on diving suits and go into the depths to operate one

warm water, leaving six or eight minutes during which the air in his suit will keep him alive.

By experience, they have learned that a careless descent toward a deck of a sunken battleship can land a man smack down a funnel and into stygian maze, or into a deck hole caused by a bomb. The metal can they stumble over on a destroyer's deck is likely to be a depth charge ready for action. The long round object they bump into on a submerged cruiser may be a torpedo ready to go off on contact.

In deep dives they have learned the fine points of manipulating air valves both by the chin inside of the helmet and by the hand outside. The air not only supplies life-giving oxygen, but it offsets the pressure which grows as the diver goes deeper. When the air is adjusted correctly for the depth at which the diver is working, he hardly feels his bulky suit. Too much air pressure will pop him to the surface, likely to suffer serious attack of the bends, or divers' cramps. Too little pressure

and the body begins to squeeze into the helmet.

A typical example of what can happen occurred to a student diver on the Normandie job. Responding to his cries for help over his head-piece telephone other divers found him bouncing helplessly against the ceiling of a cabin, his suit bulging like a balloon—too much air.

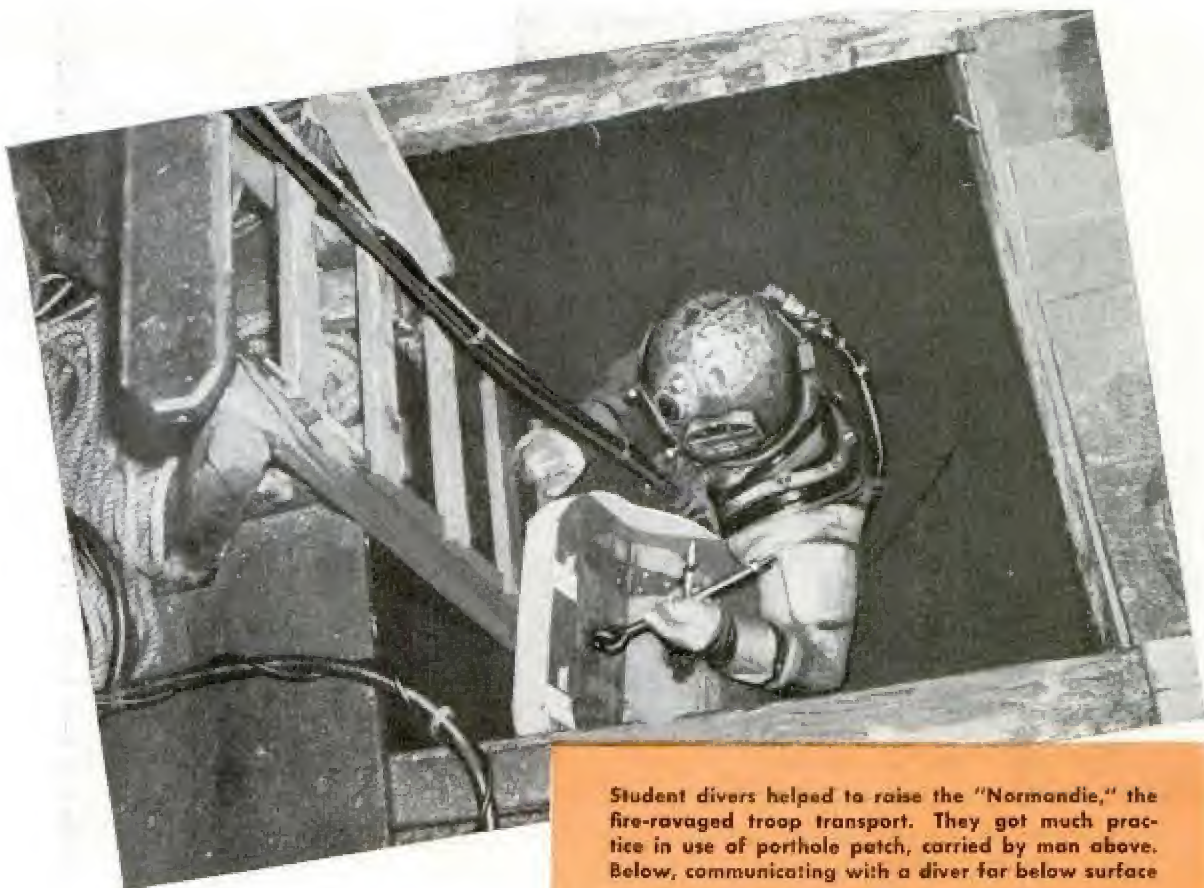
They learn never to lose track of their life lines while prowling on a derelict; never to go under anything that they can go around, never to get panicky, no matter how bad things look. One of them burned his air line through with his cutting torch, but he got to the top okay.

They have been bombed by the Japs while salvaging an American transport in the Aleutians. They have been spotted with searchlights and shelled by Germans in North Africa while cutting



First actual underwater test is in water-filled tank, where diver can be watched through port





Student divers helped to raise the "Normandie," the fire-ravaged troop transport. They got much practice in use of porthole patch, carried by man above. Below, communicating with a diver far below surface

boom cables across harbor mouths. They have braved a mine field in the Atlantic to unbolt a destroyer's deck guns for salvaging. They have slogged through sunken enemy warships searching for code books and important papers. They have brought up range finders and other expensive equipment off cruisers lost in battle. They have plugged up holes in sunken drydocks in Arctic cold and shored up tankers cracked in two in the tropics.

And the background training for all this they have obtained at the informal school at Pier 88, where much of the equipment was built by the students themselves and many of the training methods were also developed on the scene.

Men considered for training are between 20 and 30, and closer to 20, since older men cannot stand the pull and haul of the currents and the weight of the diving gear. They will be muscular, without an ounce of excess fat. Fatty tissues have scanty blood supply and can not quickly rid themselves of nitrogen which accumulates during under-water work. They will be of quiet disposition, not phlegmatic, but steady of nerve, because the strange depths



of the sea are no place for a man who is inclined to be very excitable — or very dumb, either. In one of the classrooms they exhibit a diving suit slashed down the front as a reminder that its wearer lost his head, and nearly lost his life, when he became snagged underneath a platform and accidentally cut off his air in his struggle to free himself.

Even when hand-picked, every third man fails to complete his course. Many are washed out in a hurry, because the first





Diver above descends with oxygen-hydrogen cutting torch. Below, stopper permits diver to haul rope or cable without danger of its slipping back  
Official U. S. Navy photos

thing a man does in this diving school is dive.

If he can't stand the confinement in the suit, if fear freezes his heart when he discovers himself far down in the muddy depths of the Hudson River, if he can't work in total darkness where his hands become his eyes—he simply won't do.

Even if he gets by on the diving test, he has to prove that he can stand far greater depths than the 40 feet down to the river bed alongside Pier 88. His ability to take high pressure is probed in a steel testing chamber which simulates any degree of air pressure. Men with sinus trouble, or impairment of the lungs and upper respiratory tract are likely to experience tell-tale pains which warn they will never stand the gaff of deep sea work. The candidate also undergoes rigid medical examination before he is allowed to begin work in the classrooms.

Crammed with theory and fully acquainted with his equipment, the diver is put in a suit and introduced to his gas torch with oxygen-hydrogen flame, and the new electric arc torches for under-sea burning of metals.

In one of three tanks, 10 feet high and 7 feet wide, filled with water and with a glass-covered hole through which he is watched, he does his first under-water cutting job with two or three members of his crew pumping air through his lines as they will later on at sea. After he has learned to cut metal and weld it while under water, he leaves the tanks and goes to work on a typical shoring or bulkhead job.

One problem consists of fitting tongue-and-groove timbers into their proper spot and bolting them firmly into place.

In another, the location of a sunken cylinder, submerged in the river, is indicated to the student and he is told to dive, examine it thoroughly with his hands, return topside and then draw an accurate sketch of this object—



which might obstruct traffic in a harbor or river under American attack.

He learns to tie rope knots and splice wire and cable, and to rig and operate lines and slings to remove guns, other equipment and salvageable cargo of all kinds from sunken ships.

By the time he has absorbed these things he is getting to be a diver and one day he becomes the most expensively dressed man in the navy—his diving ensemble costing about \$1,500, more than enough to tailor an admiral.

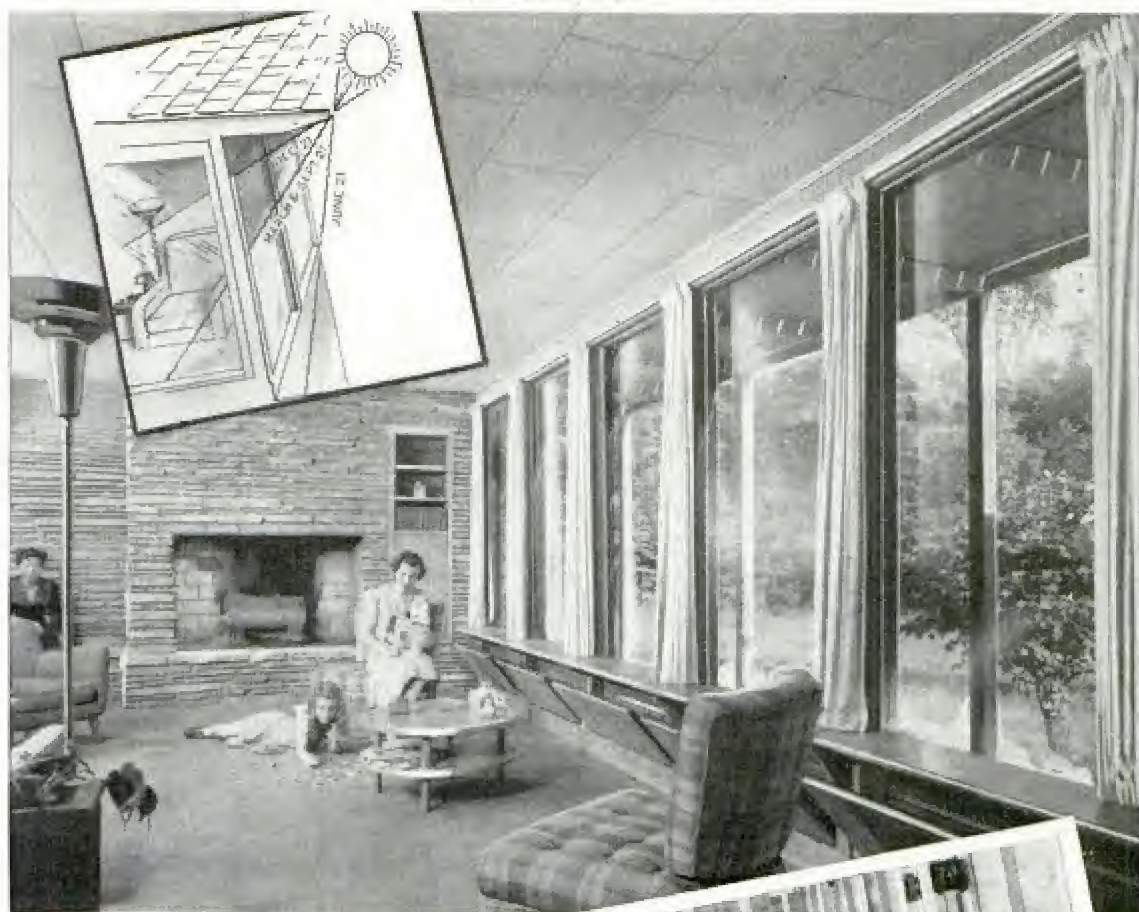
But, who knows? An occasion may come when success of a naval operation will depend less on the admiral pacing his deck than on such a diver, groping in the mud below.



*Solar Architect:*

*George Fred Keck, Homewood, Ill. 692*

## "Solar House" Reduces Fuel Bills by One-Third



Windows in "solar house" have dehydrated air spaces between panes. Inset shows "sun visor" eave. Right, floor-heating unit

Although solar heating was first used in China some 3,000 years ago, nobody got around to making an accurate day-to-day check of its value until recent years. The Illinois Institute of Technology has just conducted a 365-day test on a one-story six-room "solar house" in Homewood, Ill. The house has large windows of "thermopane" glass with a sealed-in, dehydrated air space between the panes. The tests showed that even during sub-zero weather the rays of the sun provided sufficient heat during daylight hours. On the coldest day of the year, when outside temperatures ranged from 5 to 7 degrees below zero, the solar heating system was so effective that the furnace, controlled by a thermostat, shut off at 8:30 a.m. and did not turn on again until 8:30 p.m. Fuel bills were reduced approximately one-third by heating with the sun's rays, according to

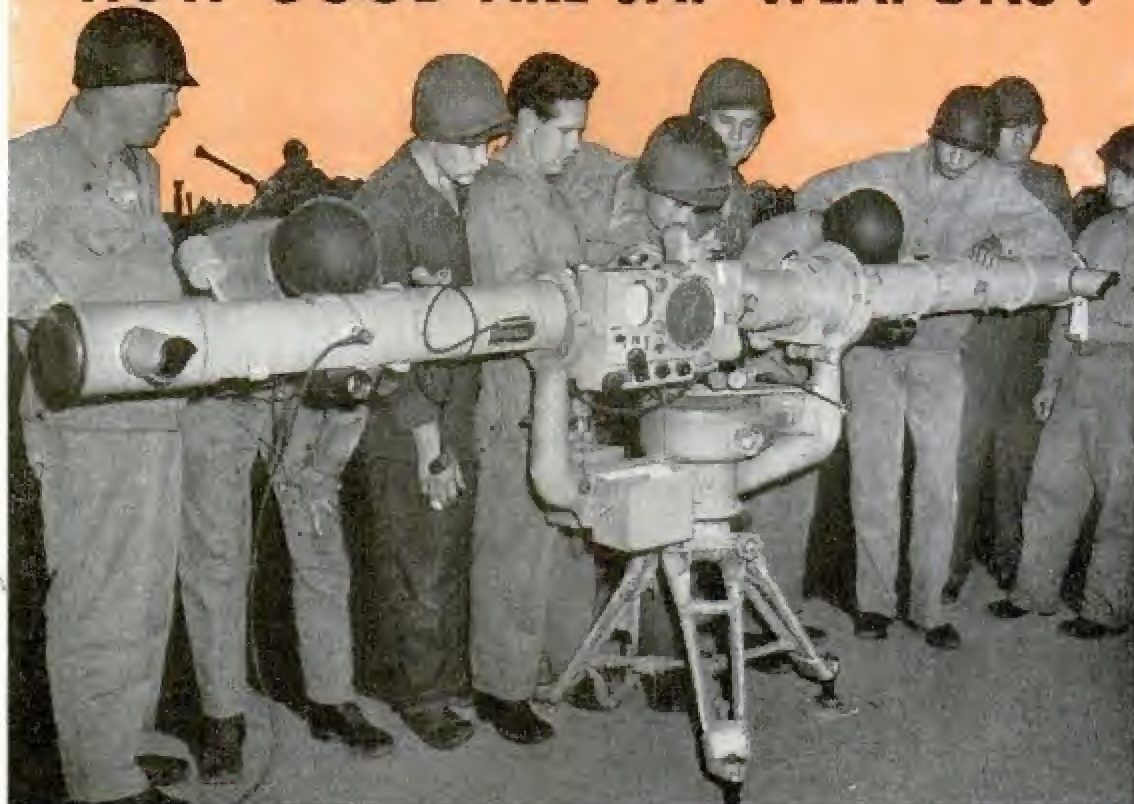


the institute engineers. The house, built by George Fred Keck, pioneer solar architect, has "sun visor" eaves that protect it from direct rays of the sun in summer. During the night, or on cloudy days, the house is heated with a gas-fired hot water system with pipes laid under the floors.

■ Navy blimps out sub-hunting over the North Pacific are helping build the nation's food supply by reporting the location of schools of fish by short-wave message to fishing vessels.



# HOW GOOD ARE JAP WEAPONS?



Inspecting a captured height finder of German make. It was found to be optically an excellent instrument

By Lt. John H. Bennett

**W**HY didn't we blast the Japanese off the face of the earth two weeks after Pearl Harbor? Why is our exterminating process so slow now?

Ordnance officers at the base field shop of the Western Defense Command and Fourth Army tell us one good reason. After weeks of testing captured Japanese arms, ammunition and mines at Fort Ord, California, these experts say:

"Japanese guns are good—very good..." Then they add, "But in the long run, against our weapons, they're not quite good enough!"

On the whole, Jap guns are smaller than ours, lighter, and less accurate at extreme ranges. Obviously they have been designed to accommodate the Nips' squat stature; the short rifle and light machine gun stocks, the low shoulder rest on the 20mm. antiaircraft, antitank gun, the

small, dangerous knee mortar. Even their hand grenade is smaller. At first glance these miniature instruments of war look like toys, until you learn how effectively they can spit death.

Let's consider the latest Jap rifle, more than one pound lighter than any rifle we have. This Model 1939, caliber .303, is a decided improvement over the caliber .25 piece they popped so annoyingly at us in



Ordnance officers put a Japanese heavy machine gun to firing test

*Publication Officer, Sp. Sp. Act.  
235th Ord Bn, Camp, A. P. O. 184,  
of Ordnance, Los Angeles, Calif.*



the early stages of the war. It's a bolt action weapon, cocking on the forward motion of the bolt like our old model 1917; is clip fed, five rounds per clip, and is sighted through a rear folding leaf with no correction for windage. Singular features are a monopod for use in prone firing; a plastic muzzle cover, a sliding bolt cover for protection against dust and snow; two folding arms on either side of the rear sight leaf providing leads for antiaircraft fire. If the Japs shoot



Firing one of the Jap 20-millimeter antiaircraft, antitank guns

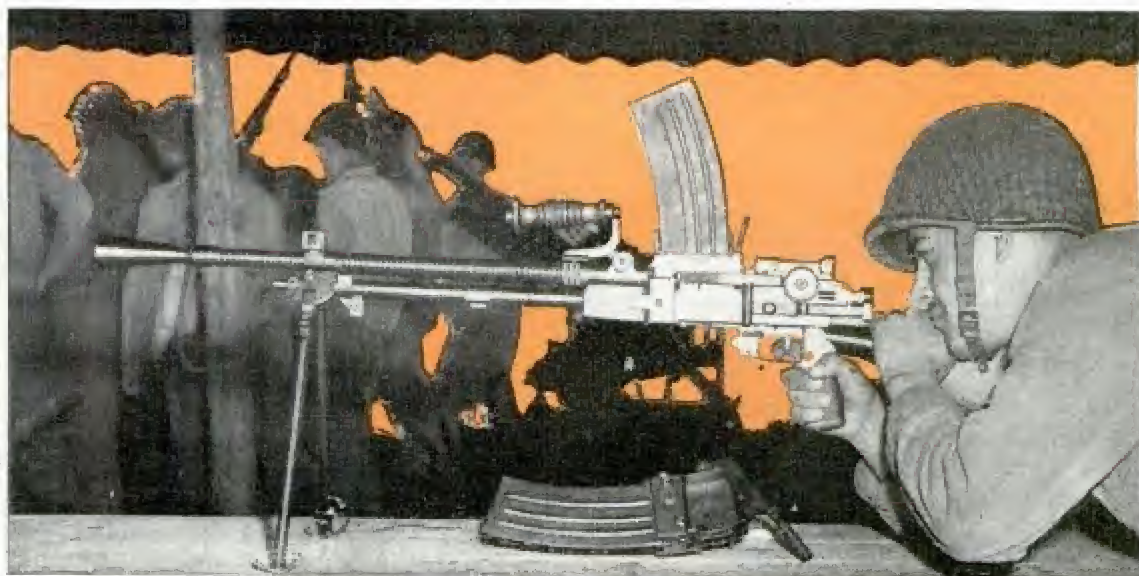


Above, a heavy grenade protrudes from tube of captured "knee mortar." Below, Jap light machine gun with 35-round magazine

wide within 350 yards, it isn't the rifle's fault. Four Ordnance officers fired just as accurately with this piece at that distance, as with any of our own weapons. But beyond 350 yards—as one officer remarked wryly: "A good big gun will beat a good little gun every time."

The Japanese light machine gun, Model 99, caliber .303, uses the same ammunition as their rifle, in five-round clips. A small oiler attached to the loader oils each cartridge as it enters the magazine, as on the heavy machine gun. The purpose is not altogether clear, unless extreme weather conditions render dry cartridges difficult to extract. Both weapons functioned perfectly without oil when tested in California.

The light machine gun can spew out its full magazine of lead in less than three seconds. It fires 600 to 900 rounds per minute. It's as accurate as the rifle, and considerably lighter than our 1919 A4.







Jap Bangalore torpedo is made of 1½-inch pipe sections filled with TNT

The Japs fire it from the ground, the hip, or, as on Guadalcanal, from the tops of trees.

An Infantry Captain, leading his company up a valley on Attu, was driven to cover when one of these guns blazed forth from a bluff. For three hours the company was delayed until the Captain himself crawled out on his belly to flank the enemy. In twenty minutes he found one Jap, crouched in the rocks behind one light machine gun. Jap number two had been killed by rifle fire. The Captain rose slowly, and from 200 yards, put a bullet through the Jap helmet.

The Captain's comment on the gun is typical. "It can't touch our 1919 A4 at 500 yards," he recalled. "But at short ranges—look out! The Japs didn't design it. It's a sort of cross between the British Bren, and the French Hotchkiss, gas operated, air cooled; but the Nips can use it."

Another officer returned from the Aleutians, agrees the knee mortar is most effective; but puts the 20mm. antiaircraft, anti-tank gun second. He pointed to it, sitting on its antiquated wooden wheeled mount where it looks so awkward and ineffective.



"They take the wheels off, spread the outriggers 120 degrees apart and spike them down. Sure it's light, but they have to manhandle it, don't they? They pulled one of those devils up a 3,000-foot mountain. Our orders were to take the pass. Well, we took it. We took it twice, and they shot us out of it twice with 20mm. high explosive shells. We took it the third time. When we reached the top, we found that gun, just as silly looking as it is now, four dead Japs around it. Some people laugh at it. It isn't funny to me."

The Japanese 20mm. gun, Oerlikon type, fires armor-piercing as well as high-explosive shells. It's a gas-operated, air-cooled, magazine-fed weapon . . . with an elevation of 85 degrees and a depression of 10 degrees. Maximum horizontal range is 5,450 yards, maximum vertical range, 12,000 feet.

Reports from every land action against the Japanese carry implicit comment on their heaviest infantry weapon, the heavy machine gun, Model 92. Patterned after the French Hotchkiss, this air-cooled, gas-operated gun has an effective rate of fire between 200 and 250 rounds a minute. Its accurate range exceeds the rifle and light machine gun by 200 yards; it will fire 3,000 to 3,500 rounds without overheating. Although the caliber is the same as the rifle and light machine gun (7.7mm., caliber .303), the heavy machine gun uses special ammunition, ball or tracer, with a heavier propellant charge. Ammunition is supplied in 30-round metallic strips which may be linked together as the gun is fed. Two pairs of sights and two mounts adapt the gun for either ground or antiaircraft firing quickly. Its telescopic sight, incidentally, is one of the finest optical pieces the Japs did not design. It is German made.

One weapon captured on Attu supplied an amazing climax to the tests at Fort Ord. It was a mortar 70mm. in diameter. There was no provision for elevating or traversing this mortar, once it was implanted. The projectile was an

(Continued to page 152)

Loading a high-explosive shell into Japanese 75-millimeter gun





Nose views of Liberator show, left to right, how firepower was stepped up as result of combat experience 71 783

## Liberator Nose Shows Growth of Firepower

How battle-testing suggests changes in the armament of a heavy bomber is best illustrated by studies of three production models of the famed Liberator, B-24. The original's nose carried only one machine gun. Presumably enemy fighters found that a head-on attack against such light armament was profitable, because an in-

termediate model of the "Lib" shows up with three nose guns. In the current model, a halt has been called to the mere addition of guns, and the nose of the bomber has been entirely redesigned in order to accommodate a power-operated gun turret. Its installation brings to four the number of power turrets on the B-24. 71 750

## Inspectors Walk Blimp 'Valley' Hunting Flaws With Light

It takes a good eye and the balance of a circus aerialist to make good as an inspector of Navy airship bags. Wearing specially designed moccasins, girl inspectors work in teams at the Goodyear Tire and Rubber Company plant in Akron, Ohio. One leads the way while a second girl holds a light as they stroll through the "valleys" of the huge blimp bag. A third inspector inside the bag follows the light, and all keep a sharp eye out for defects.



"Comin' 'round the mountain" atop airship bag, inspectors work in teams. The third member of the team works inside



# FLYING TROUBLE SHOOTERS



Army mechanics learn from a Boeing factory representative how to repair the motors of a Flying Fortress

**M**EET the M. D. (Doctor of Mechanics) of the aviation industry—a traveling troubleshooter whose territory is the world. Some companies call him a “field serviceman,” others refer to him as an “engineering serviceman” or “factory repre-

sentative.” He’s a sort of consulting physician of aircraft ailments. He isn’t supposed to do the actual repair work but gives advice to Army, Navy and Marine Corps mechanics. At least that’s the story. In actual practice, more often than not, he

rolls up his sleeves and pitches in.

All the big names in aviation — Douglas, Boeing, Lockheed, Martin, Consolidated-Vultee, North American, Curtiss, Vega, Vought-Sikorsky, Brewster, Republic, as well as smaller companies, engine makers, and equipment manufacturers — maintain a foreign legion of engineering servicemen around the globe.

They provide liaison between the manufacturers and the armed



Servicing hundreds of cables—the “muscles” of the B-17

*Andrew Hamilton, Jr.  
4-20-45  
San Diego, Calif.*



forces. Every change in propeller, engine or plane creates new service problems. The factory representatives must be on hand to explain changes and new service methods.

At the same time they keep comprehensive notes on the performance of planes in battle and send reports back to the engineers who designed them. If serious "bugs" develop in a plane on several battlefronts, changes are made on the assembly line. If the changes are not so serious, new parts may be shipped overseas and installed in the planes.

As long ago as September, 1941, Douglas Aircraft Company set up a great repair base "somewhere in Africa" where several hundred factory representatives established facilities to re-assemble, repair and maintain American-built aircraft. Specialists were gathered from such companies as Lockheed, Curtiss-Wright, Wright Aeronautical, Bendix, Pratt & Whitney, Republic



Factory men sometimes "hitch-hike" home as radio operator (above). American engineers (below) help repair bombers on African desert







Official U. S. Air Forces photo

Trouble shooters follow their craft around the globe. This is a fighter being readied in the Andreanof isles

and others. Crash crews from this outfit flew to the front to repair damaged planes on the spot. Others were scattered in strategic locations in support of British and American armies.

One of Boeing's service engineers was sent to Egypt several months ago. With a crew of Army mechanics, he sweated in temperatures that hit 115 degrees Fahrenheit, fought flies and sand and dust. Some of the crew went balmy from the heat. The rest swallowed salt and vitamin pills and kept going.

"The working schedule was seven days a week—12 to 14 hours every day," he says. "Someone has called this a war of spare parts. I agree. Spare parts are every bit

as important as the completed planes pushed off the assembly line. You'd know what I mean if you could see a dozen planes lined up on the ground—helpless because they were lacking small parts."

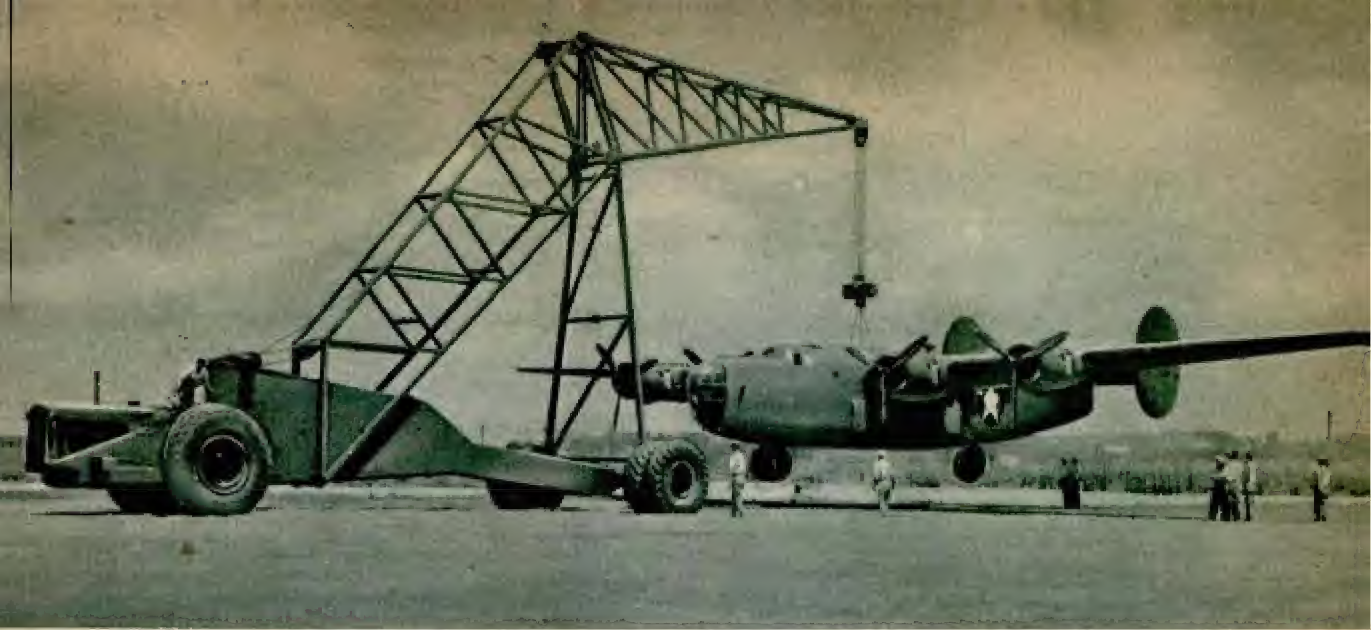
More than once the Boeing man flew 2,000 miles to salvage parts from wrecked planes to bring them back for installation in other ships. Sometimes he flew into the heart of the desert with nothing more than a tool kit and a bit of flat stock to patch up a cracked-up plane. Often he juggled parts, borrowed landing gears, engines and sections so that grounded planes might fly.

He tells of one four-motored Boeing Flying Fortress that was grounded because it had no propellers. Then someone got the

You'll meet Douglas and Lockheed men in the heart of Africa. These camels tote material for a new airport







A gigantic crane developed by Army Air Forces flexes its muscles and lifts a four-engined Consolidated B-24

bright idea of using propellers from a two-motored Douglas A-20, a medium bomber.

"As far as I know," he says, "there's a Flying Fortress somewhere in North Africa flying on A-20 propellers."

Aviation field servicemen hop around so quickly and unexpectedly that the home office sometimes doesn't know where they are. The earth seems to swallow them up and they reappear half way around the globe.

One Pratt and Whitney representative made last minute adjustments on a batch of fighting planes en route to the front. One of the planes was forced down—miles from any service facility. The engineering serviceman flew to the stalled plane, made the adjustment and decided it was serious enough to require adjustments on all the others. He started off again and caught up

with the other planes 7,000 miles from the factory.

His job completed, he tried to get passage home but found every plane was booked solid for weeks. However, he happened to be a radio "ham" and signed on a plane as radio operator for the homeward journey.

The R.A.F. hunted all over the British Isles before they could locate another Pratt and Whitney man for a hurry-up job. They found him in Northern Ireland.

"Grab your tool kit and toothbrush," he was told. "We've got a rush job for you in Russia."

Within the hour he was flying to Russia. The R.A.F. was experiencing engine trouble with its planes there.

Landing at a Russian airport, he peeled off his coat and for 48 hours straight tin-

(Continued to page 146)

Liberators are being serviced at an overseas air base. In foreground are stacked wings for Curtiss P-40's





## Razor Uses Radio Battery For "GI" Shave in Field

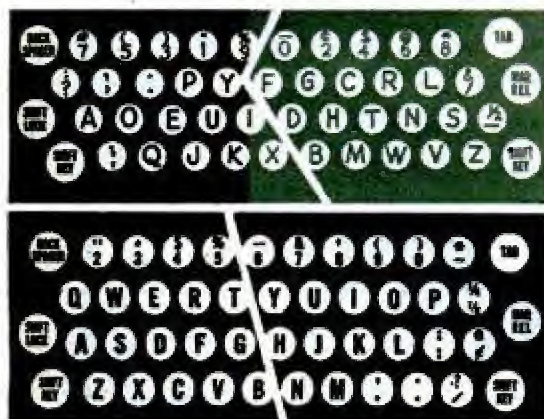


This soldier in Italy carries his own power plant

One U. S. officer solved his shaving problem while on the march in Italy by hooking up his electric razor with some discarded radio batteries. The soldier, Capt. E. MacDonald Nyhen, of Brookline, Mass., reported that the battery-operated razor worked well, and might be used successfully by hunters, explorers and others who find themselves far from a source of electricity.

## Speed Keyboard for Typewriter Gives Right Hand More Work

Navy stenographers are breaking speed records for typing with a reshuffled keyboard that gives the right hand 56 percent



Lines divide work for hands; new keyboard is at top

*Standard Steel Spring Co.  
Corroding Div.  
Pittsburgh*  
of the work. On standard keyboards, the right hand has only 43 percent of the labor. The new keyboard was designed by Lt. Comdr. August Dvorak of the U. S. Navy and is being installed in many Navy offices. Skilled typists can do 180 words a minute with the Dvorak keyboard, and coast along at speeds above former world's records.

## Steel Surface Is Made Rustproof By Low Cost Electroplating

Postwar window screens, wash tubs, garbage cans and other household articles may be made to last two and a half times as long without rusting, according to tests conducted on metals which have been electroplated with a new nickel-zinc process. The secret of the treatment, known as Corroning and developed by the Standard Steel Spring Company of Coraopolis, Pa. is in the application of thin layers of metals and alloys. In one process a layer of nickel some 50 millionths of an inch in thickness is first electroplated on base stock. This is coated over with a nickel-zinc alloy. The cost is reduced by the thinness of the layers. The smooth slate-gray finish is said to have excellent paint adherence, and can be welded or soldered without breaking, or burning away the coating.

## Light Beam Flashes on Target To Show Where Gunner Aims



Adjusting the light-beam projector mounted on gun

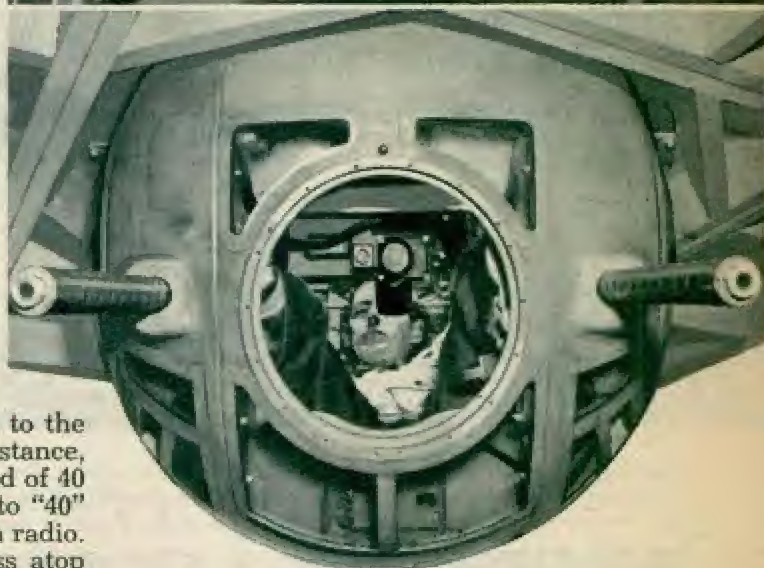
Student gunners at the 37 mm. gunnery school at Fort Knox, Ky., are perfecting their aim with a light beam that is flashed on the target. Attached to guns used by trainees is a projector rigged to flash a beam on the target so the instructors can tell exactly where the student gunner is aiming. The projector was invented by Corp. Jack Henry of San Antonio, Tex.



*Sperry Gyroscope Co. Inc.  
Manhattan Bridge Plaza  
Brooklyn, N.Y. 756*

## Gunsight 'Works Sums' To Outguess Attacker

With the aid of the Sperry computing gunsight, which virtually thinks for itself, turret gunners of Flying Fortresses can down enemy pursuit planes up to 1,000 yards away. The sight keeps the turrets' .50-caliber guns trained on the attacking plane by computing automatically the "fall" of the bullet because of gravity, the ballistic deflection caused by wind, and the amount of "lead" to compensate for the attacker's speed. So far as the gunner is concerned, when using the automatic device he seems to aim directly at the target. The sight, however, points the guns continuously and automatically at the spot where the target will be by the time the bullets arrive. Trained to recognize the various types of enemy pursuit planes, the gunner has only to adjust the sight control to correspond to the dimensions of the attacker. If, for instance, the attacking plane has a wingspread of 40 feet, the operator twists the knobs to "40" on the dial, much as he would tune a radio. Peering through the reflecting glass atop the sight, he gets two illuminated vertical lines on the target, one at the tip of each wing. By operating a foot treadle, he spreads the verticals to keep them on the wing tips as the attacker roars in—meanwhile also controlling the movement of the turret. These two actions are interpreted



With enemy plane lined up in Sperry gunsight, above, Fortress guns (below) automatically range on target

by the computing sight to set the proper range, calculating relative speed between target and bomber and multiplying the finding by the projectile's time of flight.

## Gunners Perform 'Gymnastics' Sighting Antiaircraft Gun



It takes an athlete to operate one of the Navy's antiaircraft cannons. To peer through the automatic sighting device while operating the gun, gunners must bend backward into an almost horizontal position. While the gunner performs his sighting "gymnastics," he listens to firing instructions relayed by a helper from the control officer.

Gunner's position isn't due to trick photography. He has to bend backward like this to peer into the gun sight



# QUARTZ--the MYSTERIOUS JEWEL of WAR



General Electric Co. photos

Above, quartz crystals as they are mined from the earth. In the final processing (below) experts finish the crystals by hand grinding, using electric comparison gages to achieve the exact thickness desired



7479  
THE reason why a paratrooper can plug in to headquarters by radio while he is still drifting toward the ground is because of a little slab of rock the size of a postage stamp in his transmitter.

The reason why radar works so well in detecting aircraft through fog and night, why surface craft and submarines can be located at a distance is likewise because of thin slabs of rock.

This rock is quartz, though of a much higher quality than an ordinary quartz boulder. Quartz crystal has been a popular semi-precious gem because of its remarkable transparency. Now, for an entirely different reason, it is a highly prized jewel of warfare.

Thin wafers cut from quartz crystal have a mysterious reaction known as the piezo-electric effect. Squeeze a quartz slab and it generates electricity. Apply alternating current to the slab and it vibrates mechanically. A tuning fork may vibrate 200 times per second, a violin string 3,500 times, but a wafer of quartz crystal a quarter inch thick vibrates about one million times per second when electrically excited. The thinner the wafer, the higher its frequency of vibration.

This characteristic can be used to control the wave length of a radio transmitter. When a quartz slab, called a crystal oscillator, is placed in the circuit, the transmitter radiates at a frequency that corresponds to the crystal's vibration rate. The oscillator confines the transmission to a pinpoint of frequency in the radio spectrum, enabling many radio circuits to be used in a narrow band without interfering. It is far more accurate than any other method.

The result is that from a small field radiotelephone a commander has scores of "direct lines" to aircraft, tanks, artillery, and other

POPULAR MECHANICS





Crystal blanks are sawed from slab (top) marked for complete utilization

units of his command. His radio operator simply switches to a crystal oscillator of the desired frequency and broadcasts to the desired unit. Tanks and airplanes may use scores of different frequencies during a battle and each shift is accomplished by plugging in or switching to a different slab of quartz.

It really isn't fair to refer to a crystal oscillator as a mere slab of rock. Each is shaped with such meticulous accuracy that a single careless stroke in grinding could change its characteristics. A wafer is cut from a quartz crystal with a diamond saw, inspected under polarized light for impairments, and then viewed through X-ray equipment for proper orientation. The wafer then gets a rough surfacing in a mechanical grinder, in lapping machines to create more finished surfaces, and then goes to a hand expert who reduces the wafer to the exact thickness required.

A crystal expert needs patience, a delicate sense of touch, and ability to make extremely accurate electrical measurements. A finished wafer has surfaces parallel to within 10 millionths of an inch and its thickness in some cases is controlled within 50 one hundred millionths of an inch. The expert tests his



Above, steps in cutting oscillators, from natural crystal at left, rear, to square wafers in foreground. Chips in front are scrap. Below, lapping machines used in intermediate stage of grinding crystals







Prospector at left uses quartz-contained ultraviolet light in a hunt for a tungsten-bearing ore. Below is a closeup of the lamp. Light source is contained in the quartz tube; the dark filter allows only the ultraviolet to emerge.



work by comparing the crystal against one of known frequency on a frequency meter. Depending on the frequencies desired, oscillators range from a quarter inch down to several thousandths of an inch thick. The shape as well as thickness of the wafer control the frequency at which it will vibrate and each must also be tested against instability under different temperatures.

Crystal oscillators are not new. Their use has merely increased hundreds of times because of the military expansion of radio. Grinding and finishing oscillators is a \$50,000,000-a-year industry. Practically all fixed-frequency transmitters and re-

ceivers employ them, including domestic broadcast stations. Land line as well as radio frequencies are governed by the oscillators and hundreds of conversations can proceed unscrambled over a single telephone circuit because crystal oscillators keep them apart.

Another application of quartz piezoelectric effect is in the science of ultrasonics—sound waves beyond human audibility. In this science the vibrations produced by a quartz slab are put to work mechanically. Ultrasonics do all sorts of odd tricks from killing bacteria and shattering yeast cells to making cold water seem boiling hot to the touch. The jarring effect of the high frequency vibrations is the cause.

Quartz is one of many forms of silicon dioxide, most common of minerals. Quartz is found as sand, rock, and crystal. Either sand or crystal can be heated to a liquid state and poured as a casting. Fused quartz made from sand is translucent, quartz fused from crushed crystal is transparent. Either type has an extremely low coefficient of expansion. Subjected to heat, fused quartz expands only  $\frac{1}{44}$  as much as copper,  $\frac{1}{2}$  as much as hard borosilicate glass. This low coefficient of expansion makes it an ideal material for standard angles and standards of length. Its thermal inactivity makes clear quartz ideal for such things as condenser lenses in motion picture projectors, where ordinary lenses crack from the heat.



This is one stage in grinding flat parallel surfaces on a quartz-crystal wafer



Fused quartz also is chemically inert against most acids and reagents. Thus it is ideal for laboratory ware. Thin strands of fused quartz fiber have great tensile strength and almost perfect elasticity. One use for such fiber is for suspending the mirror of a galvanometer instrument. The quartz strand untwists completely after being twisted through a great angle and brings the instrument back to zero.

Transparent fused quartz is an ideal optical material both because of the amount of light it transmits and because it can be ground and polished to very precise shapes. The Bureau of Standards has a fused quartz disc so flat its surface does not vary more than four 10-millionths of an inch.

Energy waves ranging from the infrared through the visible spectrum and well into the ultraviolet pass through transparent quartz with little absorption or reflection. Its high transmission of ultraviolet makes possible the "packaging" of an ultraviolet light source in a quartz tube or globe for irradiating food products against bacteria and molds, and for therapeutic uses. Such quartz "black light" lamps are also used for sterilizing air in hospitals and laboratories.

Ultraviolet radiation is used in prospecting for minerals. Ores of tungsten, zinc, mercury, and zircon, among others, glow and fluoresce visibly under ultraviolet light, each with a characteristic color.



Inspecting quartz crystals from Brazil under an arc light

Ultraviolet in a quartz container is also used for detecting minute flaws on metal surfaces, for instance the connecting rods and crankshafts of engines. This is done by rubbing a fluorescent oil into the surface, then wiping it off. Oil that remains in an invisible flaw is easily located by its fluorescence under ultraviolet light.

Prospectors recently discovered quartz deposits in North Carolina, Virginia, California and Arkansas. Engineers are blowing the tops off two Arkansas mountains to get at the new sources. Deposits in the Brazilian jungle remain our chief source, however.

Meanwhile, research workers have developed new methods that add to the supply as effectively as new deposits. Thinner saws for cutting the crystals are saving much that was formerly sawed into dust, producing a third more usable material.

Here are the quartz grid of mineral prospecting lamp and the star-shaped quartz tube of an ultraviolet therapeutic lamp





*Alexander Smith Carpet Co.*  
*295. Fifth Ave. N. Y. 17*  
**Magic Carpet Retreads Tire  
 And Uses Less Rubber**



Carpeted retread for worn tires uses thin rubber layer

It requires no magic to "ride on a carpet" when tires are recapped with the latest development, using the product of a carpet loom. The carpeted retread is overlaid on the worn tire with a thinner layer of rubber, thus effecting a great saving in the amount of rubber used, the manufacturer says. Using only 40 percent as much rubber, the new recap is woven on ordinary carpet looms with cotton warp and reclaimed rubber.

*N 796*  
**Foot Brake for Floor Trucks  
 Prevents Accidental Rolling**

To prevent accidental shifting or rolling of floor trucks and other wheeled equipment, a foot-operated brake is offered, as a substitute for the more expensive caster



Touch of the foot locks or releases floor truck brake

brakes. The unit can be mounted on scaffolds, work and tool stands, portable scales and conveyors. A touch with the foot locks or releases the unit. In locked position, a spring arrangement permits the unit to grip firmly, even if the floor is uneven.

*N 766*  
**Flip of Dial Sends Train Orders  
 By Facsimile Telegram**

Train orders are dispatched by facsimile telegram with a Western Union unit resembling a vending machine. The operation is as simple as dialing a number and dropping a telegram in a slot. The station to which the facsimile orders are to be sent is equipped with a receiving unit. Dialing a number puts both sending and receiving units in operation, and a code signal informs the operator when he can deposit



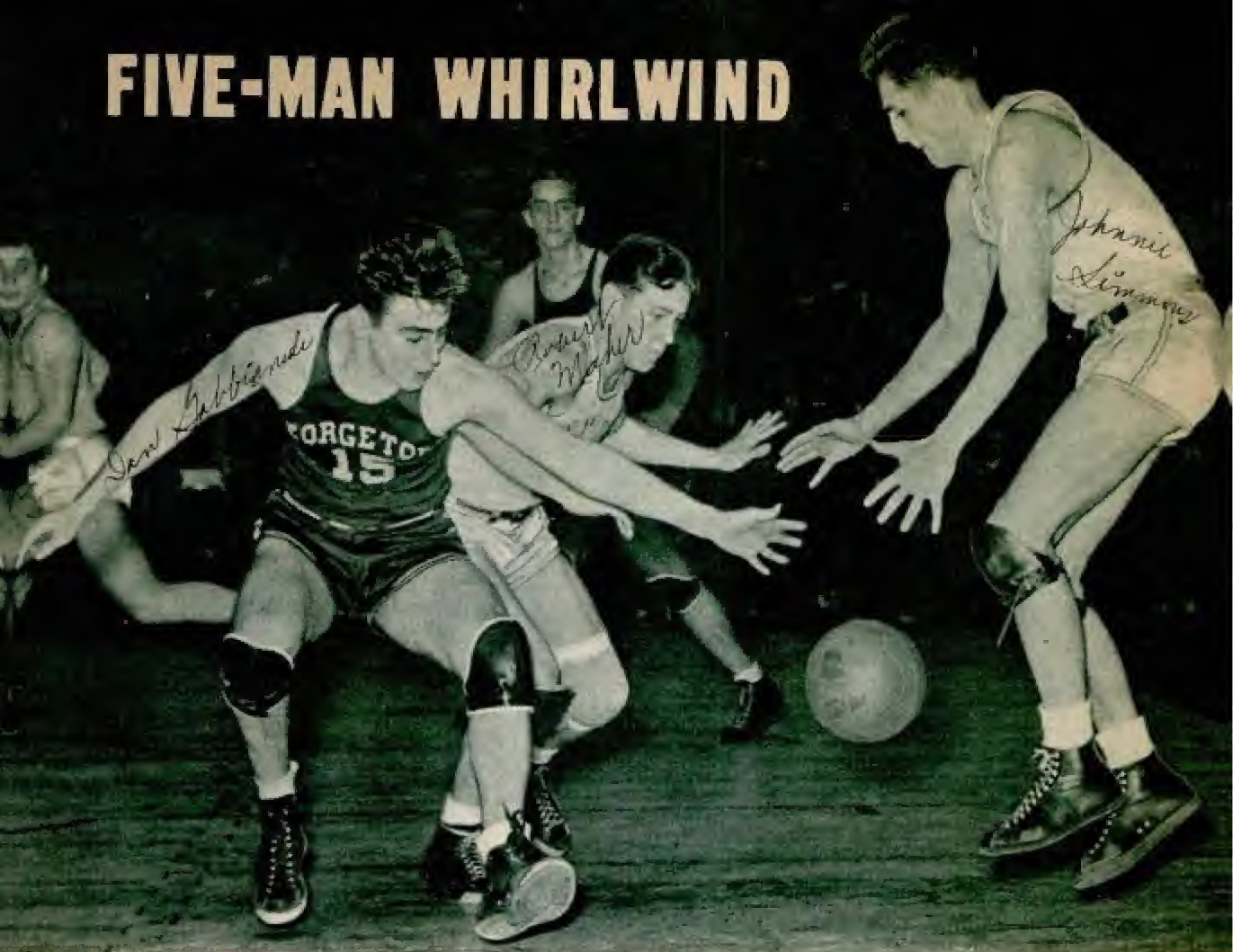
Dialing number puts both sending and receiving units in operation; then telegram is simply placed in slot

the telegram in the slot. An indicator is adjusted to send as many copies as desired, and there are no errors because the order received is a facsimile of the original.

¶After 20 years' imprisonment in a test tube at a temperature of 50 degrees Fahrenheit, the *Bacillus pestis*, dread agent of the plague, emerged alive and as deadly an enemy as ever, the United States Public Health Service reveals.



# FIVE-MAN WHIRLWIND



By Douglas R. Mills

IF I had ever had any doubts about the benefits of college sports in general and basketball in particular—which I have never had—they would have been swept away recently by a young man wearing the wings of the Navy air corps. A former basketball star on our team, he had just returned from overseas.

"Say, coach, do you remember that talk we had at the beginning of my sophomore year—when I wanted to quit?" he asked.

I'll say I remembered. He had slipped into my office late one afternoon like a scared kid. I had had my eye on him all during his freshman year because he was a most promising guard. He said he

A tense moment—for both players and fans—in the last minute of play. Below, it's anybody's ball in this speedy sport



Mr. Mills, the author of this article, was voted "basketball coach of the year" in a poll of sports writers. He is director of athletics at the University of Illinois, and as basketball coach regularly turns out Big Ten champions

FEBRUARY, 1944

Mr. Douglas R. Mills, University of Illinois, 1944, 1945, 1946, 1947, 1948, 1949, 1950, 1951, 1952, 1953, 1954, 1955, 1956, 1957, 1958, 1959, 1960, 1961, 1962, 1963, 1964, 1965, 1966, 1967, 1968, 1969, 1970, 1971, 1972, 1973, 1974, 1975, 1976, 1977, 1978, 1979, 1980, 1981, 1982, 1983, 1984, 1985, 1986, 1987, 1988, 1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025





Quintet of Illinois champions demonstrate fine art of dribbling. Below, Andy Phillip crouches to protect ball



wanted to turn in his suit and forget about trying to make the varsity team. When I asked him why, he said every time the whistle blew he got butterflies in his stomach and choked up.

He wouldn't believe me at first when I told him that was one of the best indications he would develop into a star player. He promised to give the game another try, and in his senior year that young man who is now a Navy pilot was the unanimous choice for all-conference guard. And he was asking me if I remembered!

"Well, coach," he said, "the reason I stopped by was to tell you about a discovery I made in Africa. Every time I'd get my orders to take off for a combat mission I'd get those old butterflies in the stomach. But when I stepped into my plane they didn't scare me, because I knew I was ready and sharp."

I know of no better game to prepare a man both physically and mentally for combat than basketball. It develops speed, aggressiveness, quick thinking, emotional stability, and a lively understanding of teamwork. It is probably the fastest scoring game played with a team. And while hockey appears faster, it must be remembered that the player with skates can get around with much less effort than the man in basketball shoes.

Parents come to me and say, "But the game is so fast. Isn't there some danger?" I tell them that basketball is not a mankiller in any way. The speed of the game cannot harm a player who is in good condition. In my 20 years of playing and coaching, I cannot cite a single case of permanent injury.

During the last 12 months 90,000,000 spectators attended basketball games in the U. S. Some stat-





Players leap toward ball in practice as it drops through net

isticians might be able to tell you exactly how many individuals that would account for, but I like to think of it as "the game with 90,000,000 fans."

There are a lot of reasons for the game's leap to nationwide and even international popularity in the last few years; but the two foremost are its speed, and the ease with which fans understand the fundamentals of basketball. On the other hand, my guess, and I think it conservative, is that 50 percent of the persons attending football games do not understand the rules or the execution of the plays.

The game of basketball is full of drama with the score changing in split seconds. In a game against the Great Lakes Blue-jackets, the sailors were leading with a score of 51-45 and only six minutes left to play. But in those few minutes, the Illinois team put on a basket blitz and scored 12 points, winning 57-53. In the final game of our state high school tournament last year, Centralia scored 18 points in the last six minutes to win the championship with a close 35-33 score.

This speed scoring is a far cry from the night in 1930 when Wisconsin defeated Illinois 14-9. During that same season an Illinois high school game resulted in the very odd



Blindfold dribbling helps develop correct touch, says Coach Mills. Below, spectacular shot in a game between New York and St. John's universities. The game of basketball last year attracted 90,000,000 fans







Master of the "stutter dribble" is Lou Boudreau whose change of pace confuses guards. Right, only one way to go

score of Homer 1, Georgetown 0.

Those were the days when one team could take the ball if it wished and sit on it while the minutes rolled by. In a Pittsburgh-Notre Dame game, Notre Dame insisted on playing its own zone defense and Pittsburgh wanted to play man to man. A Pittsburgh player sat on the ball for 25 minutes, winning the game. Today, the 10-second rule, forcing the offense to bring the ball up to the defense, makes such performances impossible.

Another important rule change, designed to bring more action and scoring into the game, was the elimination of the center jump. Beginning with the 1938 season, the center jump was eliminated in all instances except at the start of each period. After each score the ball now goes to the team scored upon, and play resumes

immediately. This has resulted in a much faster game and has increased the actual time the ball is in play by eliminating some 50 or 60 center jumps.

During the last year of the center jump Purdue led the Big Ten in team scoring with an average of 42 points per game. Last season all but three of our conference teams broke Purdue's old mark, and Illinois soared to an unprecedented average of 63 points per game. Every year team and individual records are being broken. A few years ago fans were amazed when players averaged 15 points per game. Last year, Andy Phillip, one of our stars, averaged 21 points per game.

Coaches no longer groan when there is no six-foot, six-inch center available. I have seen centers on the floor measuring six feet and 10 inches, but most coaches discovered that men over six feet and seven inches are not well co-ordinated and what they gained in height was lost in other ways.

Another reason for the popularity of basketball is that it is one of the cleanest sports. It wasn't always like that. Players on defense used to get away with plenty of dirt. A center on one team I knew in the old days had a bad right shoulder. If it were struck just right, the shoulder would be thrown out of joint and he would be through





for the game. One team used to knock this man out of the game on the first jump.

Another case, and this one is on the lighter side, happened when I was playing on the Elgin (Ill.) high school team. There was a smallpox scare and we all had to be vaccinated the day before we were to play one of our bitterest opponents. Knowing their tricks, we tied bandages on our good arms, leaving our sore spots uncovered. Sure enough, they hacked at our bandages all evening and left our sore arms alone.

Speed is one of the reasons for the exceptionally clean play in basketball today. Most of the shooting now is done on the move and there is little opportunity for "close work."

Intentional fouls were once rather common and many a game has been won by them. Once, smart fouling by a Loyola captain saved the day in a game with Michigan State. Loyola was two points ahead in the last minute of play when a Michigan star grabbed the ball and started for the basket with a clear field. The Loyola player grabbed him by the seat of the pants and held on. Michigan State got a free throw and one point, but Loyola won the game. Today, two free throws are awarded for intentional fouls.

Basketball is one of the few games in which practicing the fundamentals is just plain fun. This is certainly not true of football. If you doubt that, ask any tackle. Every boy likes to shoot baskets, pass and dribble. My experience in coaching has convinced me that it is harder to get a player to stop practicing than it is to get him started. Many a janitor has had to turn out the lights to clear the gymnasium floor. This love of practice has developed higher skills, such as shooting with either hand. The boy who tried a one-hander used to be considered a Smart Aleck. Today every star is expected to shoot with either hand.

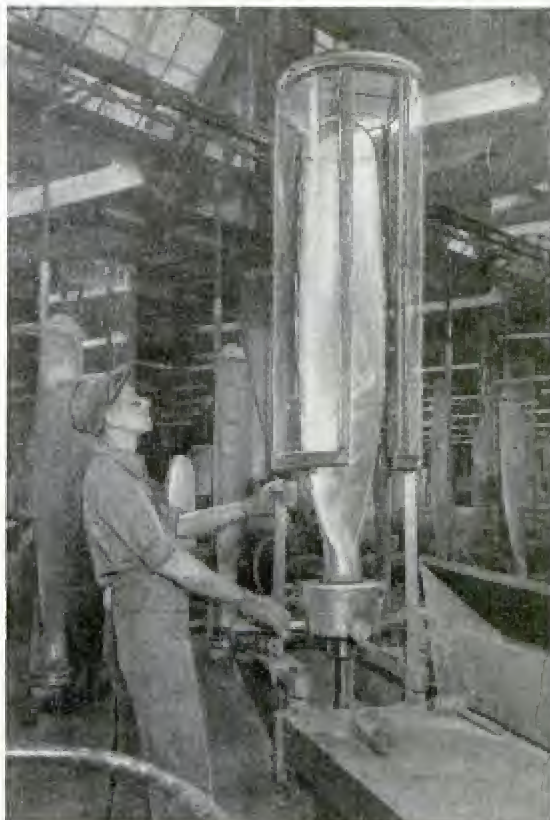
A good player develops a feel for the ball. Poor shots do not have this sense of feel and, consequently, hold the ball against the palm of their hands when shooting, instead of their finger tips. Blindfold dribbling is a splendid way to develop correct touch, also to eliminate slapping the ball.

Lou Boudreau, nicknamed the Flying Frenchman by sports writers, was one of the greatest dribblers I have ever coached. He could not only make a basketball talk, he could make it stutter. His change of pace or direction, called the "stutter dribble," was a headache to many an opposing guard. Like any good dribbler, he always bent his body over the ball to protect it.

A good basket shooter is never careless, even in practice. It's a joy to watch a player like Eugene Vance, a member of our Big

(Continued to page 148)

*Frigidaire Div  
General Motors Corp  
Dayton, Ohio 801*  
**Plastic Shield Bars Drafts  
While 'Prop' Is Balanced**



Shield keeps air from swaying balanced "prop" blade

If you've ever tried to make the pendulum of a clock stand absolutely still, so that it does not even quiver a fraction of an inch, you'll appreciate the exasperating task of men at a Frigidaire plant, who must submit airplane propellers they are making to frequent balancing tests. When the blade is mounted on the delicately balanced fixtures, a breath will make it sway as though it had life; yet it must stand still if the balance test is to be accurate. Formerly, the entire blade was taken from the grinding bench to a special enclosed room, from which drafts were scientifically barred, while the operator tested to make sure he was not grinding off too much metal. This frequent removal of the blade to the dead-air chamber wasted much time. So Frigidaire engineers developed a special transparent protective shield, which effectively prevents air drafts from striking the blade, permitting the balance tests to be made right at the bench.

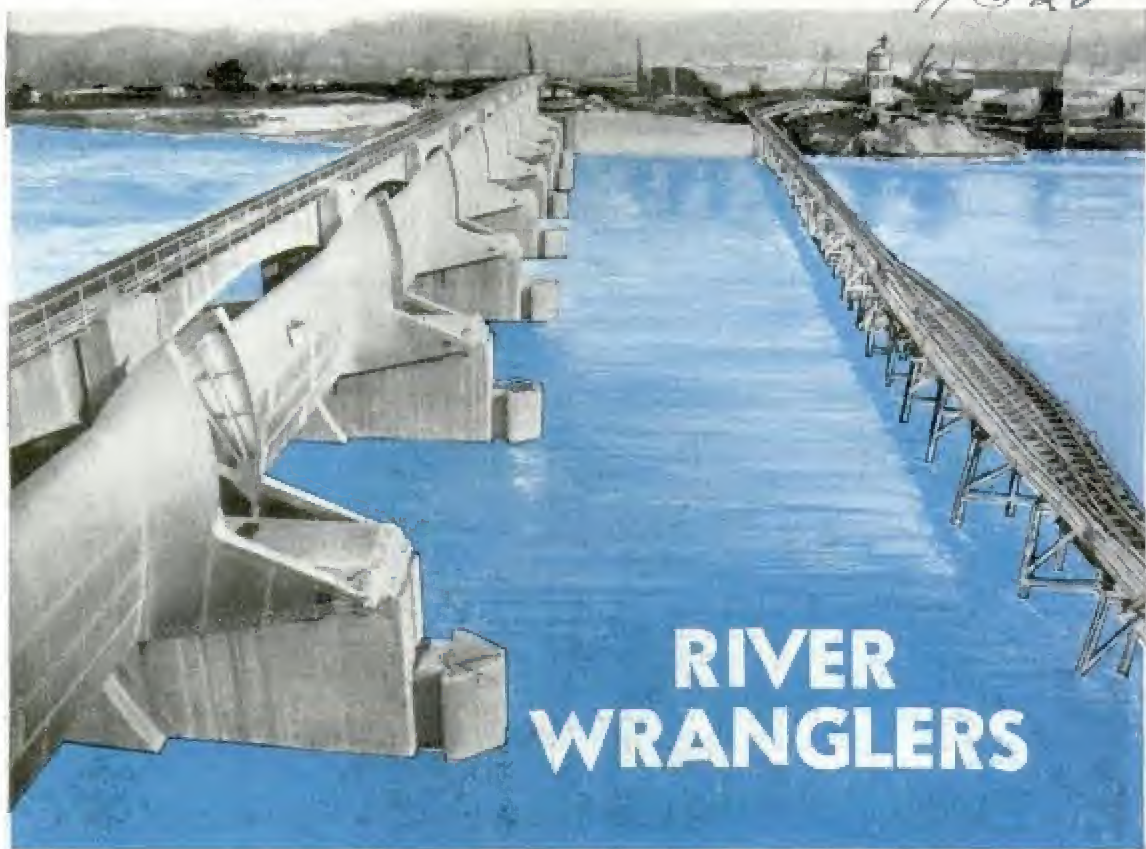
Among the "dehydrated" products on the market in addition to foods, are cements for mending furniture or glass, paint removers, silver polishes, rust preventers, and "dehydrated" wood plaster.

*L. L. Works  
Lancaster, Ohio*



Wm. Colvin

77520



# RIVER WRANGLERS

Dams like this one on Mississippi, other river-control projects add up to the "world's biggest plumbing job"

By James Colvin

**T**HE WORLD'S biggest plumbing job is getting along nicely, thanks. Oh, it springs a leak now and then, like the one that flooded out those thousands of families last spring. Not all the fittings are in yet; maybe they never will be, though the plumbers know where they ought to go.

The master plumbers, the flood-control bosses and crews of the Army Engineers, are sure they could end all these leaks in the big drain—the alluvial valley of the

Mississippi—if the Head of the House and his purchasing agent, Congress, wants to pay the bill.

The Army Engineers have been working a long time on that big drain, the Mississippi, and they expect to work on it throughout the predictable future. They can make Old Man River behave. They proved it in last spring's flood, when the tributaries cut fancy new channels across farm, woodlot and lawn, but Old Man River himself, for

the most part, swallowed the overflow and just kept rolling along, exactly where the plumbers put him, on his turbid route to the sea.

From Cairo, Ill., south, though burdened with the flow from its two major tributaries, the Ohio and the Missouri, the Father of Waters stayed in his bed—or at worst slopped over into overflow areas that had been prepared for him. Higher up, and



Amphibian jeep and rubber boat used to rescue victims of flood





along the tributaries themselves, ram-paging waters took 34 lives, drove 50,000 persons away from their homes, imperiled wartime food crops, and did property damage running into millions.

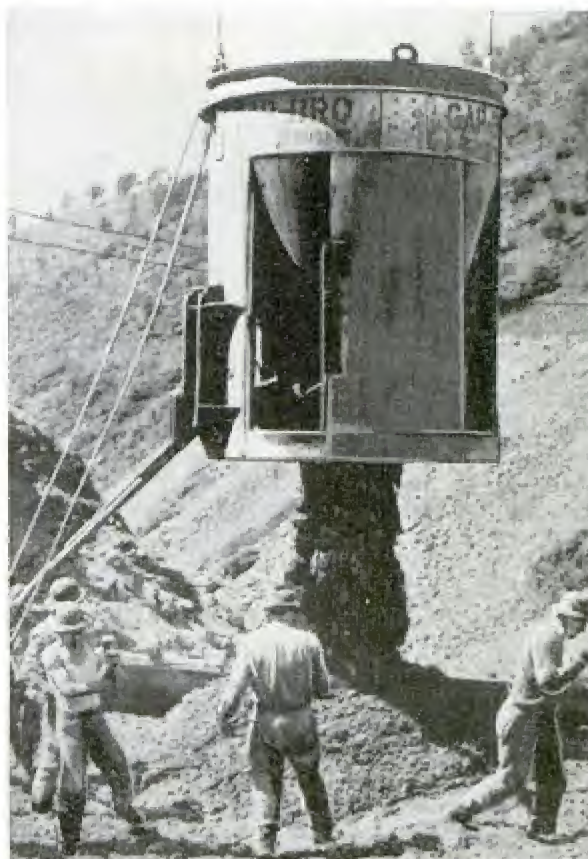
But on the lower river, safe behind the barricades and between the spillways, 3,000,000 persons continued to work out their destinies.

It was quite a contrast with the 1927 flood, which then President Hoover called "the greatest peacetime disaster in our history." That flood submerged parts of seven states, drove 600,000 from their homes, flooded almost 30,000 square miles, cost \$200,000,000.

After the 1927 flood, Uncle Sam laid down a \$700,000,000 program to make Old Man River mild. In the years since, the capacity of the main leveed channel was increased, longer bends were cut off—making Memphis 110 miles closer to New Orleans by river—floodways were designed to take excess waters out of the main channel. Massive levees were built to protect 2,500 miles of mainline railways and 2,000 miles of highways. Huge dams were raised to act as spigots, to turn on and off the flow of the streams.

The wonder of last year's floods was that the damage wasn't worse. Rivers from Illinois to Arkansas reached rec-

Water collects behind dam, above; spillway carries off excess in flood time. Below, pouring concrete at a dam







Above, levee construction on river bank in California. Below, miniature model of a section of the Ohio River at U. S. Waterways Experiment Station, where flood control theories can actually be tried in practice



ord crests. The rainfall was tremendous, and for the most part unseasonal. In the early spring the Mississippi normally absorbs the burden of rain and melting snow from a third of the continent, and floods are expected. In fact, in many areas dikes are locally built only high enough to prevent "crop floods," high water after the crops are in; the major floods generally occur earlier, out of the crop season.

But Nature crossed up the builders of these low levees by pouring it on later in the year. Men in the office of Maj. Gen. Eugene Reybold, chief of Army Engineers, take quiet pride in the fact that their structures held. It justified a lot of cranky planning.

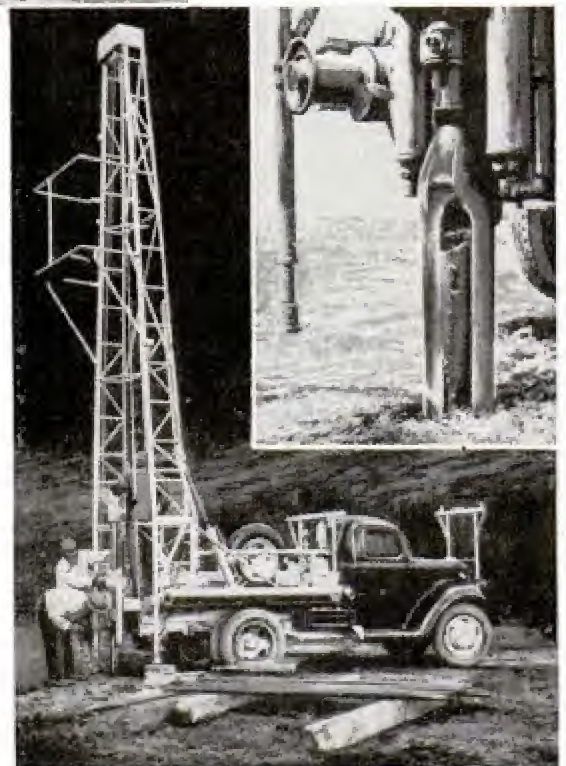
For the Army Engineers always build their flood-control projects to protect against, not the worst that has happened, but the worst that could happen. The Weather Bureau has an entire section of highly skilled prophets of disaster to figure out what would result from the worst conceivable combination of meteorological circumstances.

Their picture of "the worst" can be pretty bad; if it's too bad the project may be aban-

doned as uneconomical. But often enough the engineers have no alternative but to proceed as though the Biblical flood itself were due for early arrival.

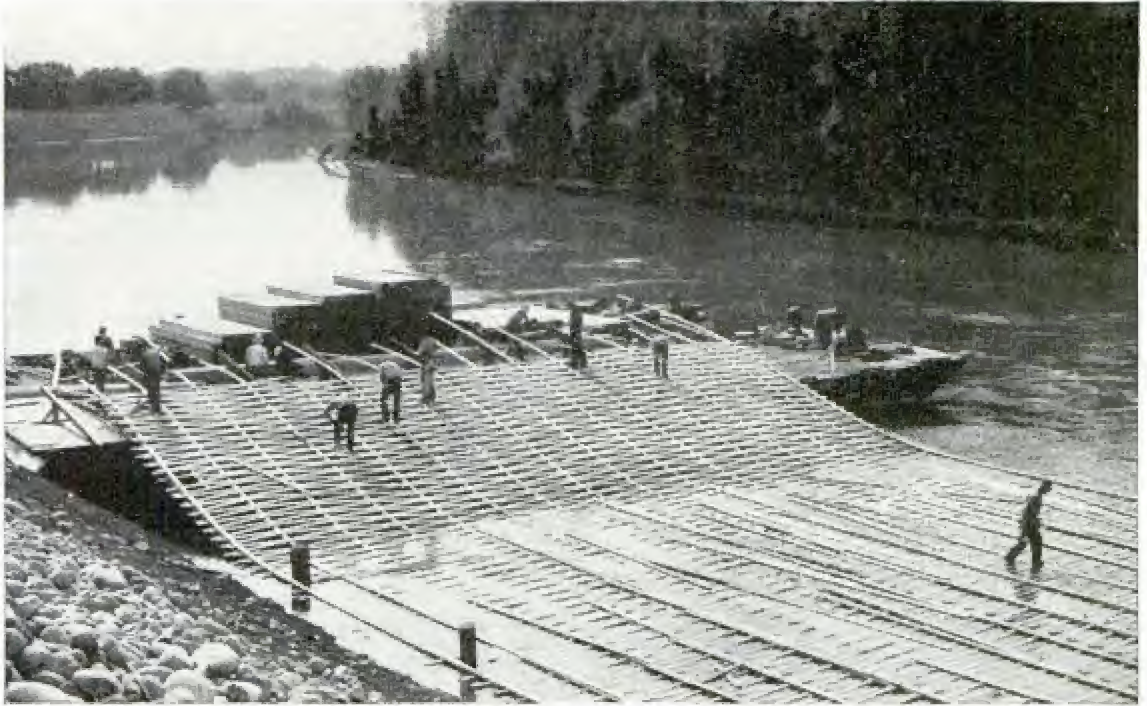
"It is possible to control floods completely," says E. W. Bassett, senior engineer, "though it would not always be economical. But we do have, or are projecting, plans that would control all the floods it would be economical to halt on most of the flood-producing rivers of the country. We are now working up detailed contract plans so that at the war's end we could immediately advertise for 300 to 400 million dollars worth of projects.

"As to how rapidly these projects are undertaken and completed, that depends on how much Congress wishes to appropriate. Before the war we were carrying on a \$100,000,000-a-year program. We could raise this



Mobile drill rig (closeup in inset) probes subsoil





Men working on bank protection and levee setback job are standing on woven lumber "mattress"

to a \$500,000,000-a-year program, if Congress felt it justified."

Because of last year's upriver floods, Congress has been under pressure to loosen the purse strings, war or no war, and get some of these projects built.

There are in the Army Engineers' office detailed maps showing just what flood-control measures have already been taken, which ones are projected and appropriated for, and which merely are in the planning stage. Needless to point out, much of this is restricted for military reasons; we know—as Germany learned to its shocked horror when the R. A. F. went dam-busting—that pent-up floods are potent weapons.

Every river in flood seems to have a personality of its own. The Mississippi's flood is like the flight of a heavy bomber, potent, relentless, predictable along every mile just as a bomber's flight may be charted by spotters on the ground. It strikes with the blow of a blockbuster, and its damage may be permanent, as swamps and bayous of the Deep South testify.

Rivers of the West Coast, by contrast, rise in

flash floods comparable to the intruder raid of a pursuit plane—upon you and gone in an instant, leaving you reeling. Such flash floods are the result of heavy rains, concentrated on the steep west slopes of the mountains. Currents in such floods reach the speed of as much as 35 miles an hour. Huge boulders are carried on the crests like air-borne feathers; bridges are rooted out and tumbled into scrap; houses swept off their foundations and ground to chips.

The Missouri is a nomad. Largely running through prairies, the "Big Muddy" got its nickname from the weight of silt it carries from its constantly eroding banks.



Sandbags piled up to protect a factory from damage by a flood  
Caterpillar Tractor Co. photo





White water foams over mountain debris control dam

And it will not stay put—or would not.

Revetments, dikes and levees have finally got the Missouri “pegged down,” in the words of Col. R. E. M. des Islets, district army engineer of Kansas City.

“It has been like experimenting on a full-scale model,” he explains. “The last flood proved the most outstanding development in 70 years. Now we know we’re right.”

Now the engineers are mapping out a vast program for reservoirs to impound that river’s overflows.

Flood control of western rivers often looks at first glance like highway construction. Principal channels may be improved with rock or concrete, to enable floods to run off faster and to keep rivers channelized. In dry weather, the broad, flat pave-

ment looks exactly like a misplaced road.

Debris dams are built in mountains, there to hold back silt and heavy stones that would otherwise plunge down the slopes onto coastal communities. In part, debris dams are needed because of extensive mining.

Building reservoirs on the short, swift, coastal rivers is often difficult because of the mountain topography, another reason the tendency is to improve the stream bed so the water will run off fast, and



Caterpillar portable Diesel electric unit provides emergency power in flood time. Left, not road building, but laying concrete river bed to speed flow of flood water



where the engineers want it.

In the Mississippi Valley, after last year’s floods, criticism took customary lines:

“Levees and dikes are no good,” says one. “The only way to stop floods is to hold back the overflow by dams and reservoirs.”

“Stop the floods at the source,” says another. “Reforest the headwaters of all the rivers; the vegetation will hold back the water.”

“You can’t set rivers on edge,” contends a third. “Abandon the



lowlands altogether. Give the rivers room to breathe."

To all of which the Army Engineers' answer would seem to be:

"Allot us the money and give us the time, and we can do all you ask, and more besides."

To the "reservoirs only" criticism, the answer is:

"A reservoir directly above a city will protect it; but if the city is too far downstream, a reservoir is no guarantee against flooding."

To those who would abandon all lowlands, letting the rivers expand and contract at will:

"In general we must use a combination—of reservoirs; levees to keep the rivers confined; deepened channels to direct the current and speed the runoff, and floodways to take excess water off through a fixed area where property loss from flood will be slight or nothing at all."

As to holding back all water by replanting:

"The Department of Agriculture studies every stream on which the Army Engineers plan flood control, to determine the best way to hold back water at the source. It can't always be done."

Army engineers do, in fact, give the rivers "room to breathe," not by abandoning all lowlands, but by making increased use of floodways. In their continental plumbing system, a floodway is like a washbasin's overflow pipe.

At certain spots along the Mississippi, for instance, when the water gets too high the levee is simply blown up at a predetermined spot. The excess water goes—where the engineers want it to go—down another channel where it will do no damage. When the levee at the Bonnet Carre spillway above New Orleans is breached, for instance, the Mississippi's floods run off into Lake Ponchartrain. Farther upstream, the Atchafalaya cutoff takes the flood about 100 miles directly to the Gulf, instead of through the main channel, at least twice as far.

Flood control requires dams, but dams are built for other reasons too. Fort Peck Dam on the Upper Missouri, for instance, was thrown up primarily to provide an even flow of water for navigation on the lower river. It creates a stupendous reservoir, with a surface area of 245,000 acres, a maximum length of 189 miles.

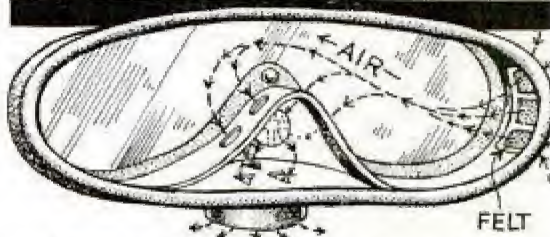
Navigation must be kept in mind whatever the engineers plan. River travel and transport fell off after the last war, but it is making a strong comeback. Long hauls of bulky, nonperishable, low-cost cargoes are cheaper by water. The impact of this

(Continued to page 154)

FEBRUARY, 1944

*Solaroid Corp.  
Cambridge, Mass. 02142*

## Breathing Clears Moisture From "Fog-Free" Goggles



Breathing brings fresh air across lens to clear fog

Ventilated by the wearer's own breathing, an all-purpose goggle for military and industrial uses is described as "fog-free." By means of vents in the side, plus a nose-piece, every breath draws a stream of fresh air through the nosepiece across the goggle lens, sweeping out all moisture that constantly is given off as perspiration by the skin, tear glands and mucous membrane. Normal breathing completely changes the air within the goggle about 50 times a minute. The ventilator is said to clear lenses of frost that accumulates when the wearer steps from a warm place into the cold.

## Seal Guards Fire Extinguisher By Enclosing Hose in Bag

Fire extinguishers are protected against tampering with a paper envelope that fits over the hose. The envelope is attached to a standard pressure-type extinguisher with a lead wire seal. With this protection, inspectors can detect any tampering at a glance.

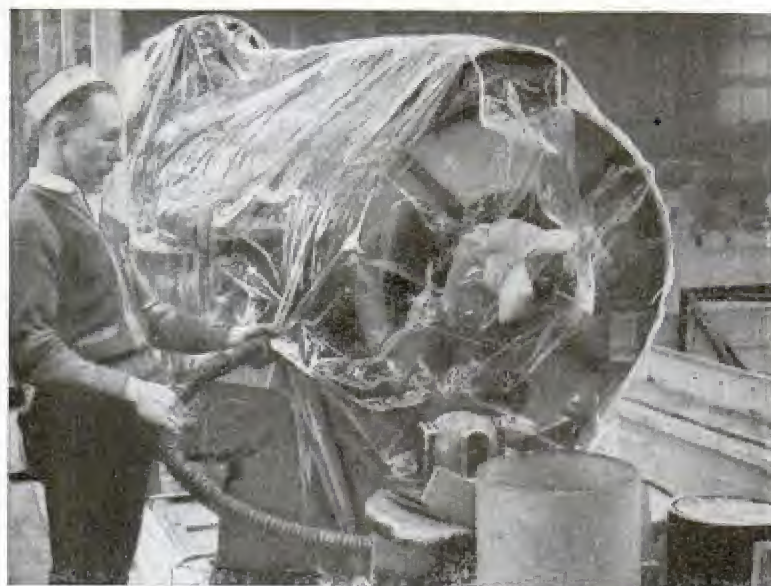


*Fredrickson Service Co.  
605 W. Washington St.  
Chicago, Ill.*



*Curtiss - Wright Corp.  
30 Rockefeller Plaza  
N. Y., N. Y. 77 652*

## "Raincoat" Holds P-40 in Vacuum for Shipment



Composed of a single piece of transparent Plio-film measuring 400 square feet, a "raincoat" completely covers Curtiss P-40 Warhawk fighter planes during shipment to battle fronts. After the bag is adjusted, a tube attached to a vacuum suction arrangement removes most of the air, collapsing the bag. As additional protection, an absorbent material is placed in bags about the propeller hub and other parts subject to corrosion.

Removing air from the Plio-film bag helps protect parts

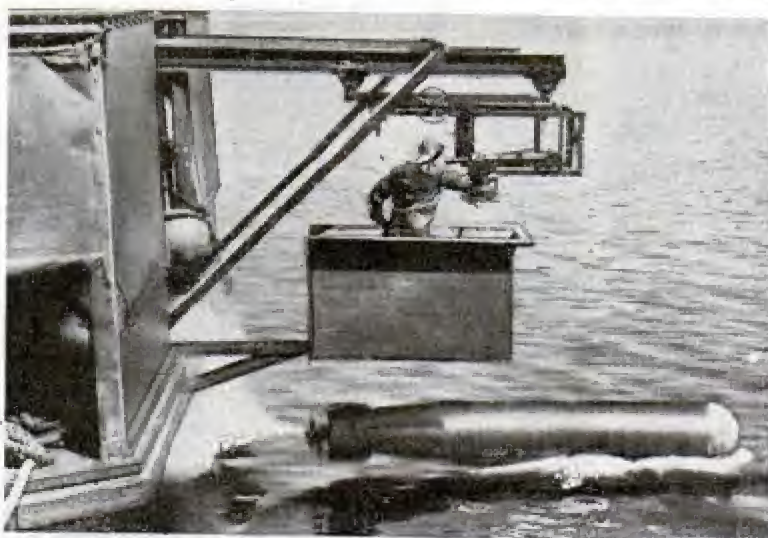
## "Flying" Tin Fish Get Test Run to Check Delicate Works

Aircraft-type torpedoes are tested at a naval torpedo station on the West Coast by launching them from a barge. The torpedoes, similar to those used so effectively against the Jap invasion fleet in the Battle of Midway Island, are launched from a special device constructed of salvaged metal. They are equipped with dummy heads for trial runs to test their clocklike works.

*Naval Torpedo Station*

Launching aircraft-type torpedo from barge for test run

*Seaside, Wash.*



## Salvaged Gun Turret on Truck Teaches Air Gunners Marksmanship



In the battle areas, almost any equipment that is salvageable can be put to good use. When one plane was wrecked in New Guinea, the gun turret was removed and mounted atop a truck, to become the open-air "classroom" for air gunners. While the truck speeds along a range, students in the bomber gunnery school utilize the salvaged turret to improve their Jap-hunting technique.

Open-air classroom for aerial gunners is this truck-mounted bomber's turret





# The CRAFTSMAN

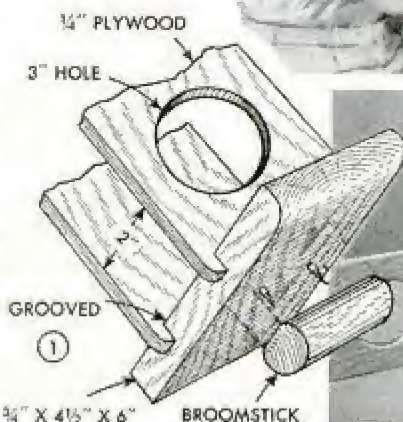


## 4 Smart BEVERAGE TRAYS

By  
Charles and Bertram Brownold

BESIDES being attractive and costing practically nothing as they are made from pieces of scrap wood, these beverage-glass holders have wells to receive the glasses and are therefore much more convenient to use than the average type of flat tray.

Tray No. 1 is a "straight six," consisting of two relatively narrow pieces of plywood set in grooved endpieces which are provided with finger grips as shown in Fig. 1. The upper shelf has six holes for glasses. It will be best to measure the glasses you intend using with this tray and then bore the holes







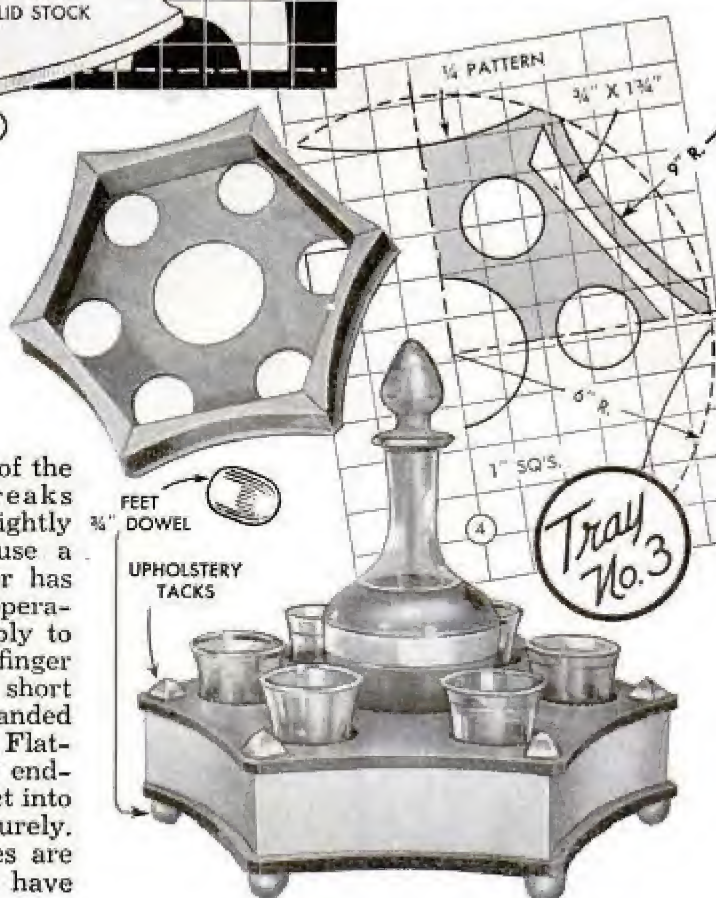
to suit them. Either an expansive bit in a hand brace, or a circle cutter on a drill press, can be used for boring the holes. As is common practice when boring such holes, be sure to back the piece of plywood with a piece of scrap wood to avoid a ragged edge on the underside of the plywood when the cutter breaks through. Then, to produce a slightly rounded edge for the holes, use a round stick to which sandpaper has been glued as in Fig. 2. These operations of boring and sanding apply to all of the trays described. For finger grips on tray No. 1, you can use short lengths of broomstick planed or sanded flat to fit against the endpieces. Flat-head screws are driven into the endpieces from the inside and project into the finger grips to hold them securely. This is done after the endpieces are grooved, but before the shelves have



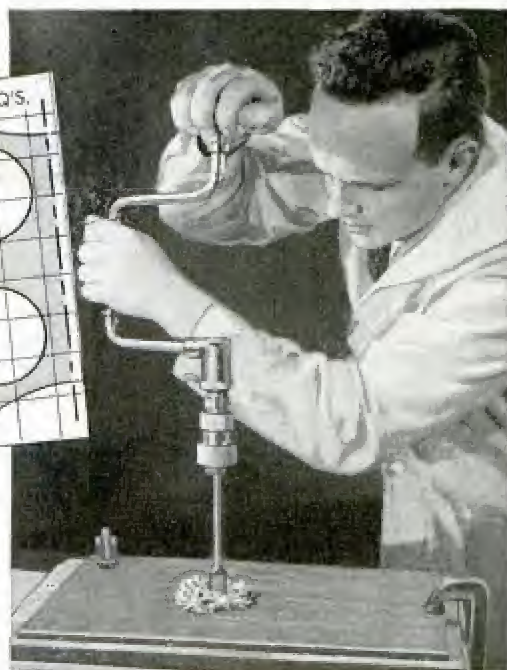
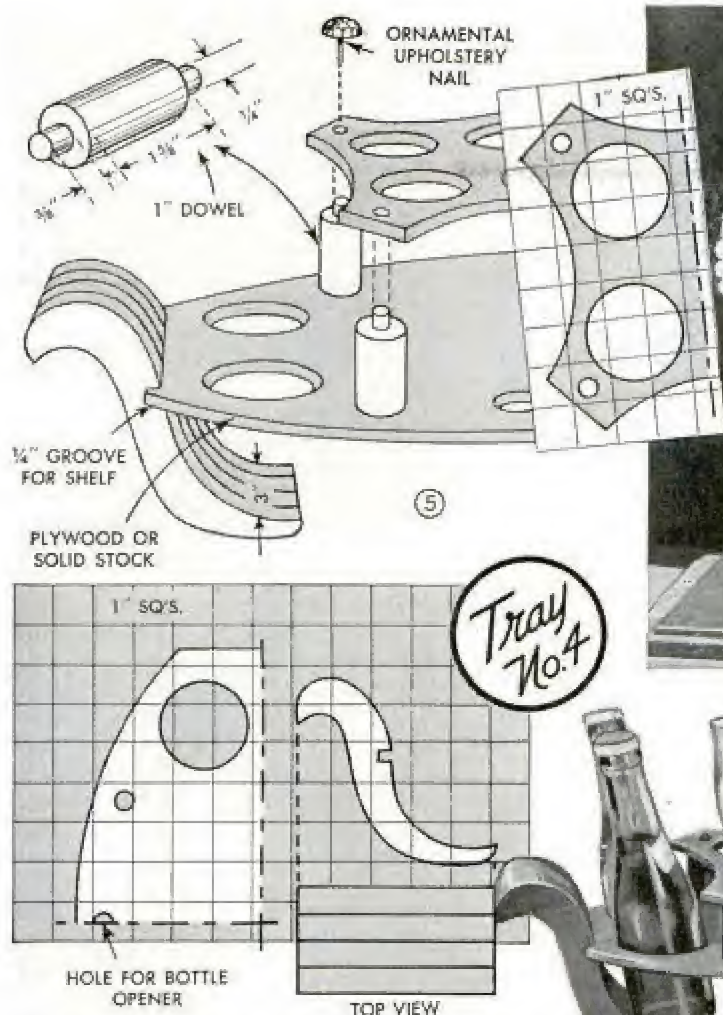
been glued in place in the grooves.

Constructed in a similar manner, tray No. 2 is wider and is designed to hold six glasses in two rows. Fig. 3 shows the shape and size of the parts. In this case the finger grips were formed from a block of wood through which a 1/2-in. hole was drilled lengthwise. Then the block was cut in half and the edges rounded as shown.

Aptly called "hen and chicks," tray No. 3 holds a decanter and six small glasses. Its construction is somewhat more elaborate than the two trays already described, but the sides







are closed, forming a hexagon-shaped box. Top and bottom are pieces of plywood and the six sides are scrollsawed from  $\frac{3}{4}$ -in. stock, so that one side is concave as shown in the pattern which is given in Fig. 4. The ends of the side members are mitered. Brads and glue hold the assembly together, the nails being driven through the plywood. Ornamental upholsterer's tacks with large heads are helpful to conceal a pair of brads driven through the top into the side members, near the ends. The six legs are made from  $\frac{3}{4}$ -in. lengths of  $\frac{3}{4}$ -in. dowels, one end of each being rounded. They are attached to the box with glue as well as a brad driven into each from above.

Tray No. 4 is a "soft drink foursome," holding four glasses and four bottles. The

curved handles are bandsawed to the shape shown in Fig. 5 and they are assembled to the shelves so that the lower ends of the handles support the bottles. Each is built up by gluing together four pieces of  $\frac{3}{4}$ -in. stock, the grain of the inner two pieces running horizontally to provide sufficient strength at the lower end to support the bottles. The upper shelf, which is bored to receive glasses, is attached to the lower one by means of four short lengths of broomstick with dowels pegged into their ends, or each may be a one-piece turning. Ornamental upholsterer's tacks conceal the upper ends of the dowels. The lower shelf has four holes to receive soft-drink bottles and a small one to take a bottle opener.

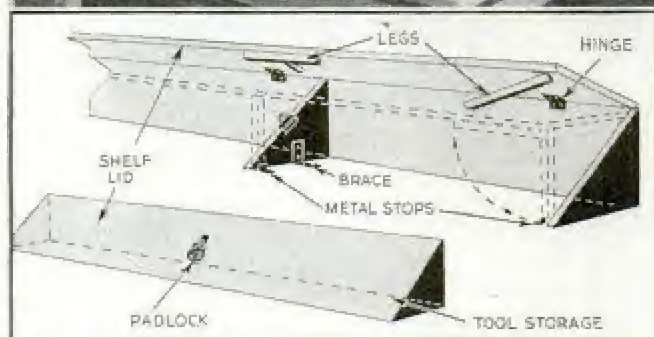
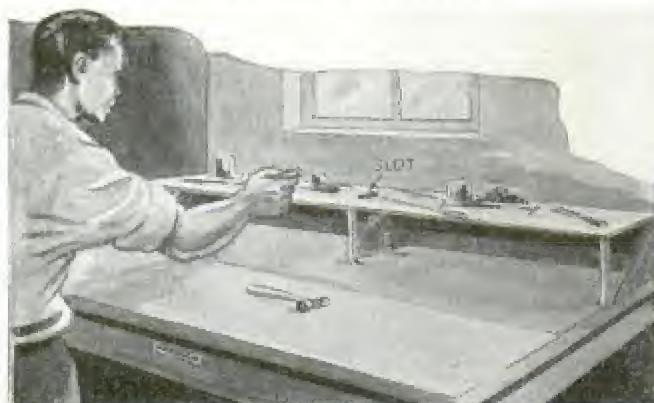
## Use Filler Dust of the Right Color When Inlaying Woods

When inlaying woods of different colors, —walnut and maple for example—the filler dust always should match the darker of the two woods being joined. And, as the glue in drying darkens the filler considerably, it is advisable to use dust made of a lighter colored piece of the same wood or a similar

wood. Walnut dust may be made up in several shades from scraps on hand and kept in small jars ready for use. For rosewood, use a dust made from the lighter streaks only or make it from light mahogany, vermilion wood or both mixed together, blending them to the desired shade.

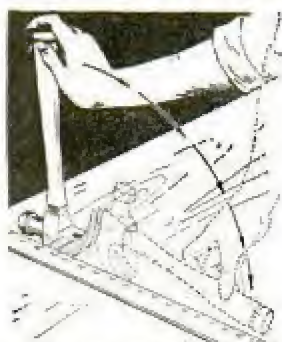


## Tools Locked Under Hinged Shelf At Rear of Workbench



Instead of putting his most-used tools in drawers and racks to keep small children from getting at them whenever he leaves his workbench for a few hours, one home workshop owner pushes them to the rear of the bench under a hinged shelf that can be folded down over them and locked. When not folded, the shelf is supported horizontally by three short hinged legs to serve as a raised ledge for tools and other parts. As shown, the shelf is hinged to the back of the bench or wall. When folded down, an enclosure is formed by two triangular end pieces, a third triangular piece being used in the center for attachment of a lock hasp, which projects through a slot in the shelf.

## Emergency Measurements Made With Your Hammer

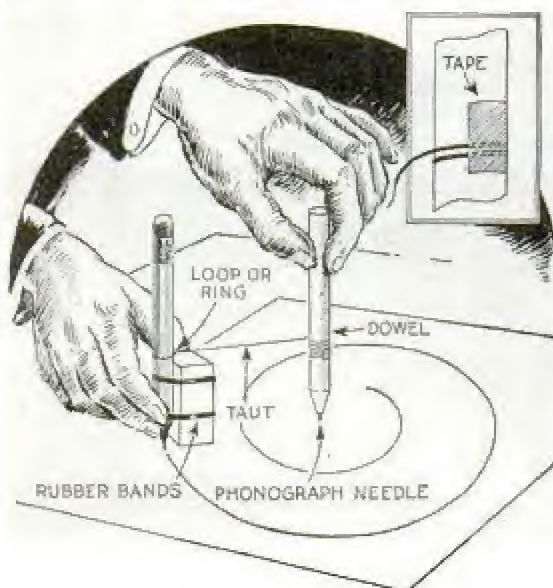


Using your hammer to make measurements that are not too critical not only saves time and tools, but also is handy at times when a ruler or scale is not available. To use a hammer for this purpose, place it on a yardstick with the peen end at the end of the stick. Then, tilt it back on the claws and down on the yard-

stick as indicated by dotted lines. Memorize the figure at the end of the handle. In cases where a given length is measured frequently such as in spacing rafters, studs, etc., this measurement can be indicated on the hammer handle by a shallow score. Now, all you have to do when making measurements is to repeat the above procedure on the work to be measured.

## Accurate Spirals Drawn By Unrolling Wire

Utilizing some fine wire, a small wooden block and a couple of pencils, anyone can produce accurate spirals. The wire is taped to a lead pencil or dowel having a phonograph needle in its pointed end, and is wound on it as shown. The free end of the wire is formed into a loop to slip over a pencil, which in turn is attached to a small block with rubber bands, giving proper support to the pencil so that it can be held vertically. The pencil should turn freely in the loop. With the point of the dowel held in the center from which the spiral is to be drawn, the block and pencil are pulled tightly on the wire and moved around the dowel, allowing the wire to unwind, thus producing a spiral. Although the hands will have to be changed at each turn, after a little practice spirals of surprising accuracy will result. The distance between the spirals will be approximately equal to the circumference of the center pencil or dowel.





# Swedish Doll Cradle Has Gay Color Scheme

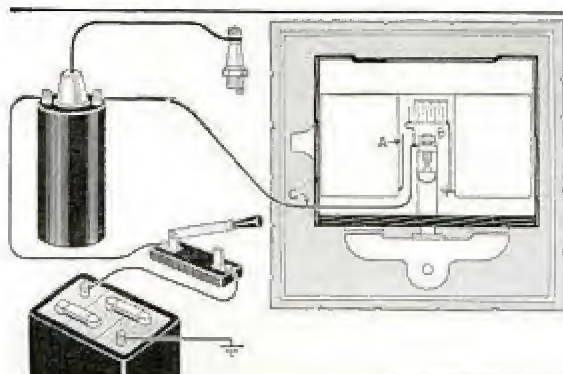


Because of its unusual decorative design, Swedish furniture is invariably attractive, and this doll cradle is no exception. White clouds, red birds, and white, yellow and brown dogs or ponies above red flowers on a light blue background produce a striking effect on the sides of the cradle, while red, yellow and brown designs on each end complete the traditional color scheme. Use  $\frac{3}{8}$ -in. stock, scrollsawing it to the half patterns given and assemble with brads and glue

## Magneto Ignition of Engine Converted for Use on Battery

When failure of a high-tension magneto of the oscillating type, often used on one-cylinder engines, makes replacement necessary, the engine can be converted to battery ignition easily by altering the magneto to serve merely as a timer. This is done by disconnecting the primary wire A from the breaker point B, and in its place con-

necting wire C to an auto-engine coil. If the magneto condenser is in good condition, it can be left connected to the breaker point, but if its condition is poor, any auto condenser can be used. One terminal of a storage battery (or four dry cells) is grounded to the engine frame and the other terminal is wired to the coil, a switch being put in the circuit for starting and stopping the engine. The spark-plug cable to the magneto is connected to the center socket of the coil.—Oscar Loken, Brocket, N. D.



## Paper Strips Identify Umbrella

Copying an idea from the manufacturers of umbrellas who place their names or trademarks on paper strips in the ribs, I put my name and address in the ribs in the same way. After typing my name and address on the paper, it is coated with adhesive and pressed into a rib with a toothpick.

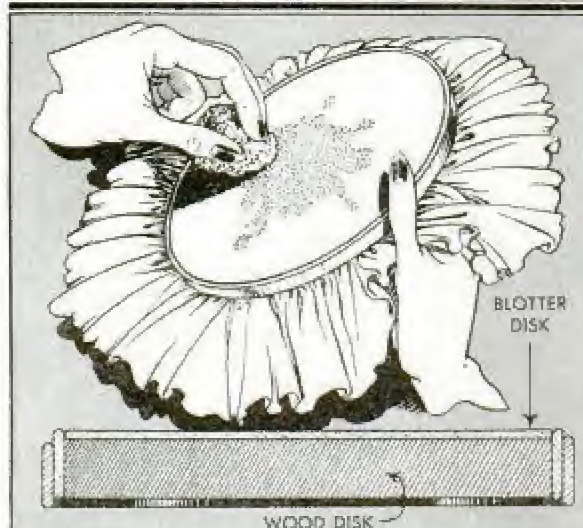
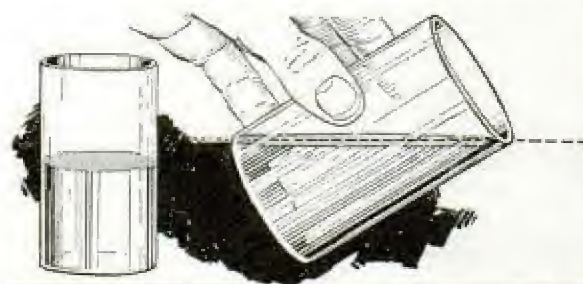
—Wm. Swallow, Brooklyn, N. Y.



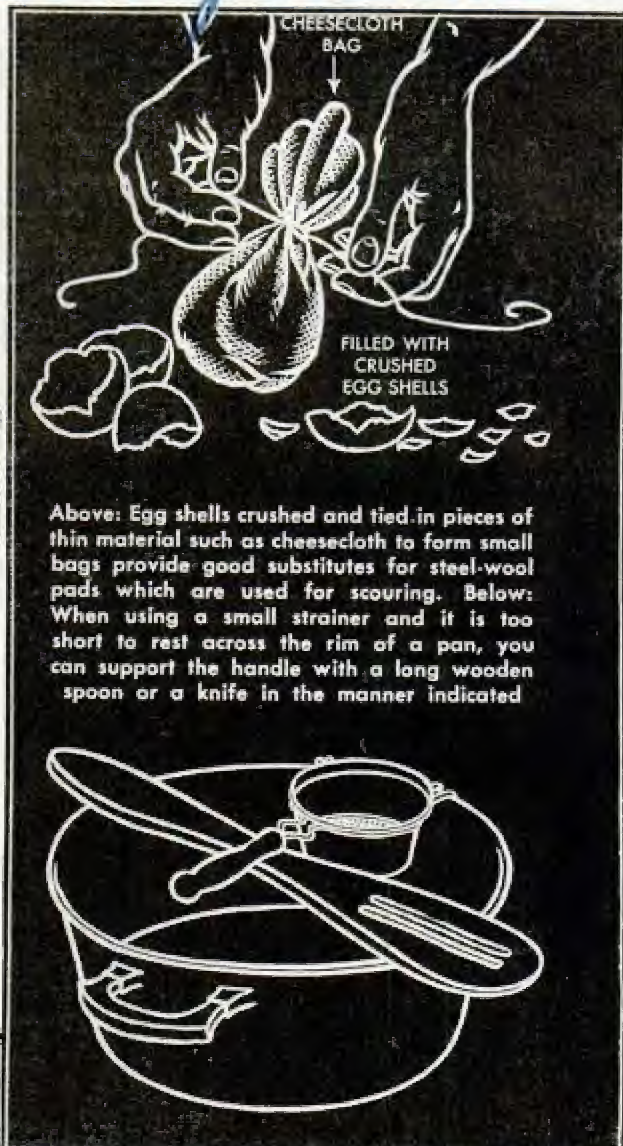
# Solving HOME



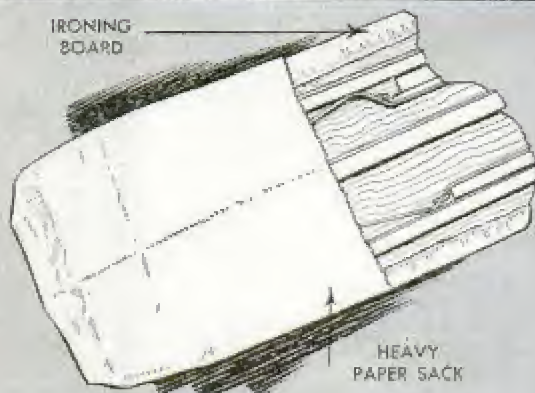
Above: Less time is required to bake potatoes on the top of a heating stove by placing a large pan over them to retain heat. Below: A half glass of liquid can be measured by pouring out the liquid until its surface extends from the mouth to the opposite side of bottom



Left: Keeping cloth taut while removing a stain is no problem if it is stretched over a wooden disk and held in position with an embroidery hoop. A disk of blotting paper should be placed between the wood and the cloth to absorb the cleaner. Right: Soiling of an ironing-board cover when the board is stood on end or the floor can be avoided by slipping a large paper bag over the lower end of the board



Above: Egg shells crushed and tied in pieces of thin material such as cheesecloth to form small bags provide good substitutes for steel-wool pads which are used for scouring. Below: When using a small strainer and it is too short to rest across the rim of a pan, you can support the handle with a long wooden spoon or a knife in the manner indicated

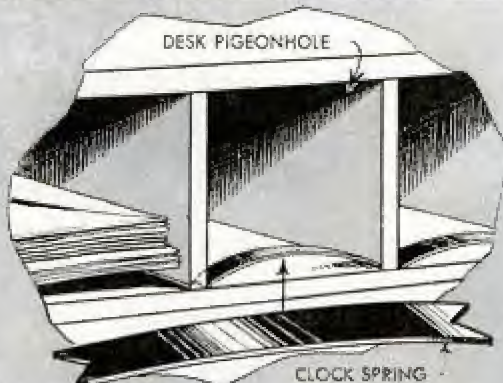
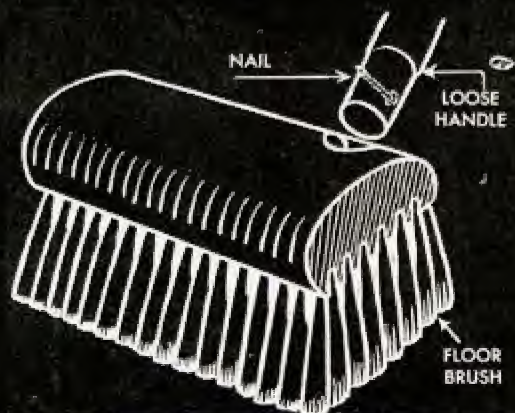




# PROBLEMS



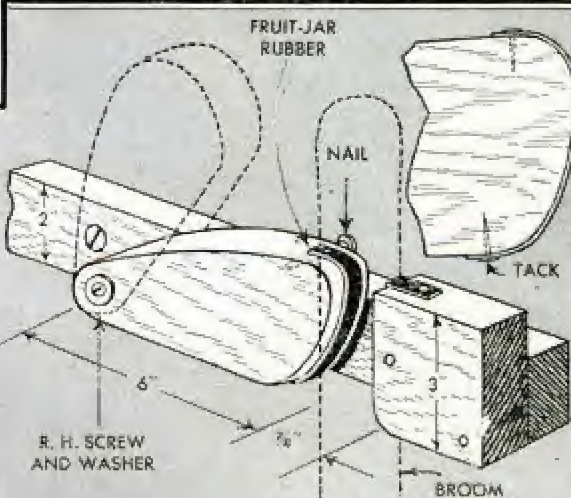
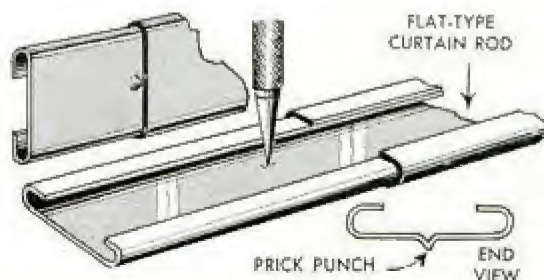
Above: Candles will burn considerably longer if they are given a coat of shellac, which tends to retain the molten wax around the wick instead of running down the side. Below: A simple way to anchor a loose handle securely in a floor brush is to drive a nail crosswise through the tenon, letting the point project to embed in the brush as the handle is turned in.



Left: To facilitate removal of papers in desk pigeonholes, place a piece of clock spring, notched at the ends, across the front of the openings as shown to elevate the contents. Right: Made up in multiple to fill your needs and fastened to the wall or the back of a door, this quick-acting broom holder relies on the weight of the broom to cause a pivoted arm to wedge securely against the handle.



Above: After most of the old putty has been removed when reglazing sash, use a piece of hacksaw blade to scrape rabbeted edges clean. Below: A punch mark serving as a stop makes it easy to extend curtain rods the right distance before climbing up to rehang them.





## Using One Runner on Drawer Saves Work and Material



While the idea of using only one runner on a drawer is not new, it does effect a saving in labor and material, and in chests and dressers, each runner can be made to serve as a stop and guide for the drawer underneath. All that is necessary is to make the runner wide enough to extend above and below the front rail to engage a notch in the back of the lower drawer. This arrangement often helps to prevent the drawers from binding, especially if they are long and narrow. If the back of the drawer is made a little higher than the front, it will strike the front rail, which then serves as a stop to prevent the drawer from being pulled out accidentally. This is especially handy where there are small children who often pull out drawers. When it is necessary to remove a drawer, pull it out as far as possible and then raise the front until the back will clear the front rail.

## Twine Waxed With Belt Dressing To Make Knotless Sack Ties

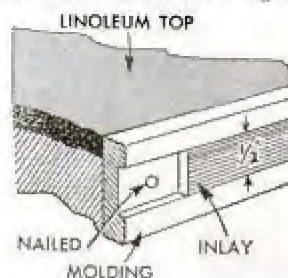


Grain sacks can be tied securely without knotting the twine and, at the same time, they will be easy to open when necessary. To do this, simply pull the tie strings across the end of a stick of belt dressing to wax them thoroughly. Then make the sack tie with

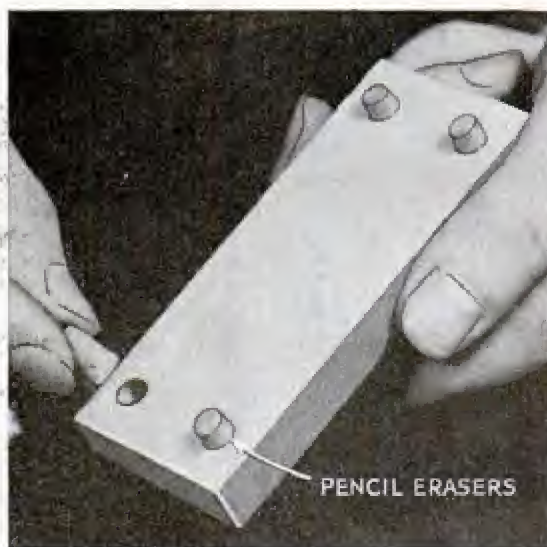
a double loop as shown, and you will find that it will hold indefinitely. Dampening the strings with water will serve the same purpose, but is not always dependable.

## Wood Edging Trim for Table Tops

A good substitute for the metal trim used on the edges of table and cabinet tops can be made from hardwood facing strips. All you have to do is groove the strips in the center and insert a strip of colored linoleum, which can be purchased already cut in strips  $\frac{1}{2}$  in. wide. The facing strips also can be purchased in widths approximately  $\frac{7}{8}$  in. wide. To apply the trim, nail it in place as indicated and then cement the linoleum strip into the groove, covering the nail heads.



## Erasers Serve as Rubber Feet On Small Novelties



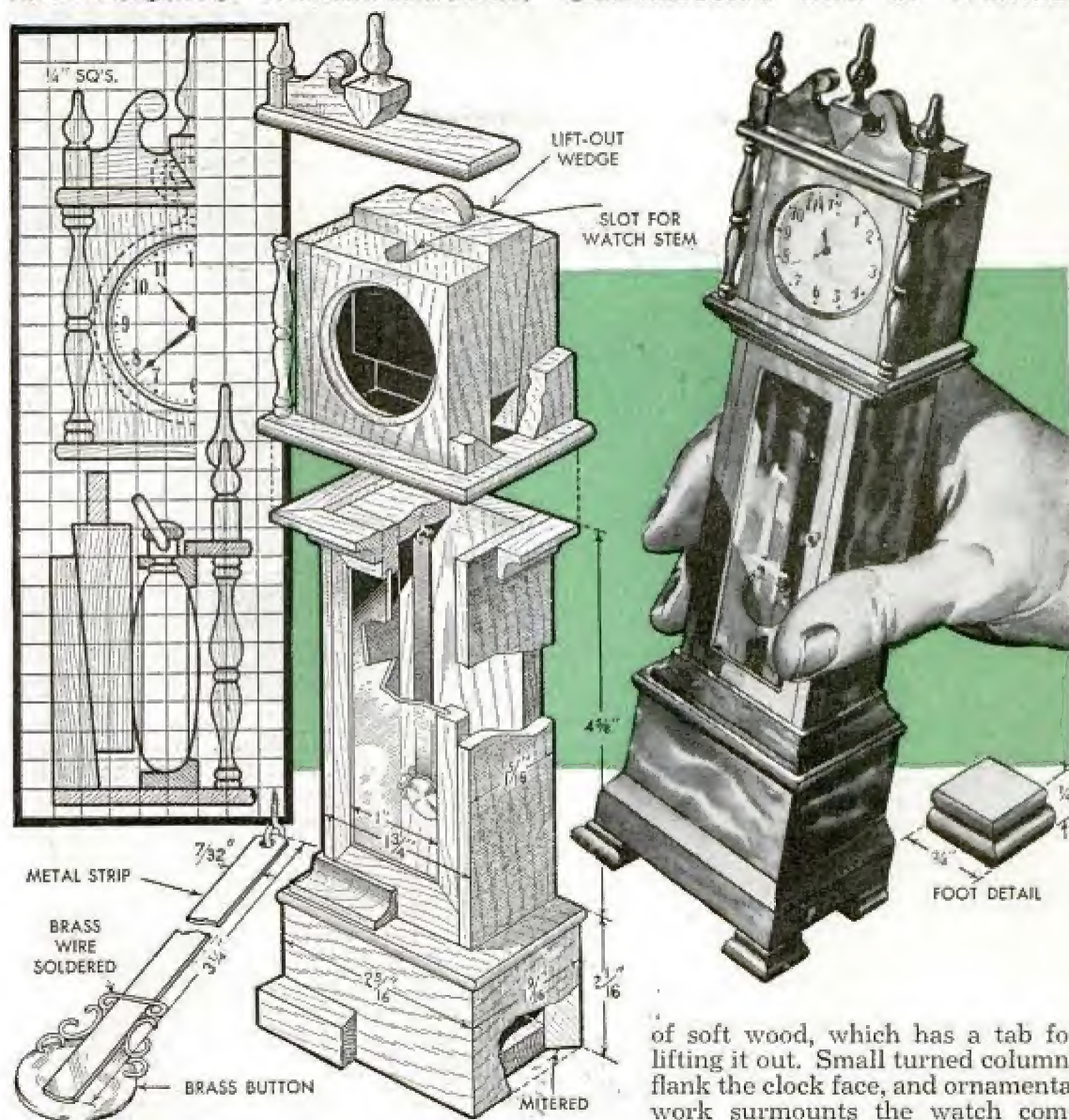
Difficulty in obtaining suitable rubber feet to prevent several homemade novelties from scratching highly polished surfaces of furniture led one craftsman to use pencil erasers for the purpose. These were inserted in slightly undersize holes drilled near the corners of the bases. A drop of glue on each eraser holds it in place.

—Herman R. Wallin, Washington, D. C.

When the noise of shoveling coal into a furnace disturbs someone who is seriously ill, just fill large paper bags with coal and lay them on the fire as needed. As the bag burns, the coal falls gently into place.



# Miniature Grandfather Clockcase for a Watch



Using an old watch and a few scraps of walnut or mahogany wood, you can make a miniature grandfather clock that will provide an unusually attractive mantel ornament, or a very acceptable gift. Measure the watch carefully and build the case to fit. The dimensions given above will be suitable for almost any dollar watch. It sets in a block that has been turned out to fit, and is held in place by a tapered block

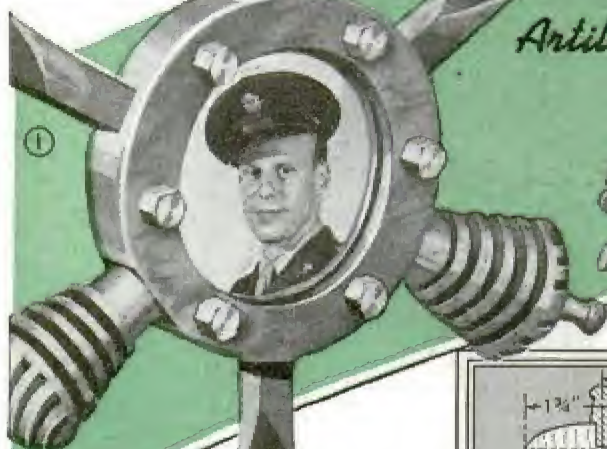
of soft wood, which has a tab for lifting it out. Small turned columns flank the clock face, and ornamental work surmounts the watch compartment. Slotted strips with mitered joints form the framework of the glass door over the pendulum. The latter, of course, is a dummy, suspended from a hook. A polished brass button serves as the weight, with some ornamental scrollwork done in soldered wire, brass if available. You can paint a miniature figure in oil on the center of the dial and delicate decorative work on the glass door. Finish the clock with shellac and wax.

## Baby's Crib Works the 'Swing Shift' as Combination Bed and Play Pen

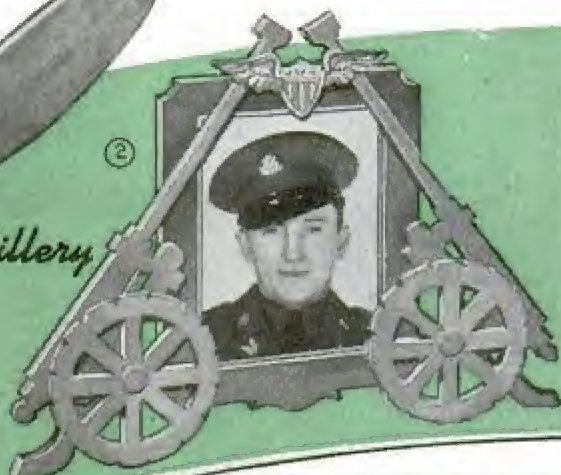
Baby can use his crib for sleeping at night and for a play pen in the daytime if a piece of hard-pressed board or plywood is cut to the size of the crib and fitted into place on top of the slats. With the mattress removed during the day, the board makes a sub-

stantial floor for baby to play on, and the crib railing keeps him from falling out. He is also protected from the cold and drafts of the floor. When baby is sleepy, merely replace the mattress, and he can be put to bed.—Evelyn Tinney, Chicago.





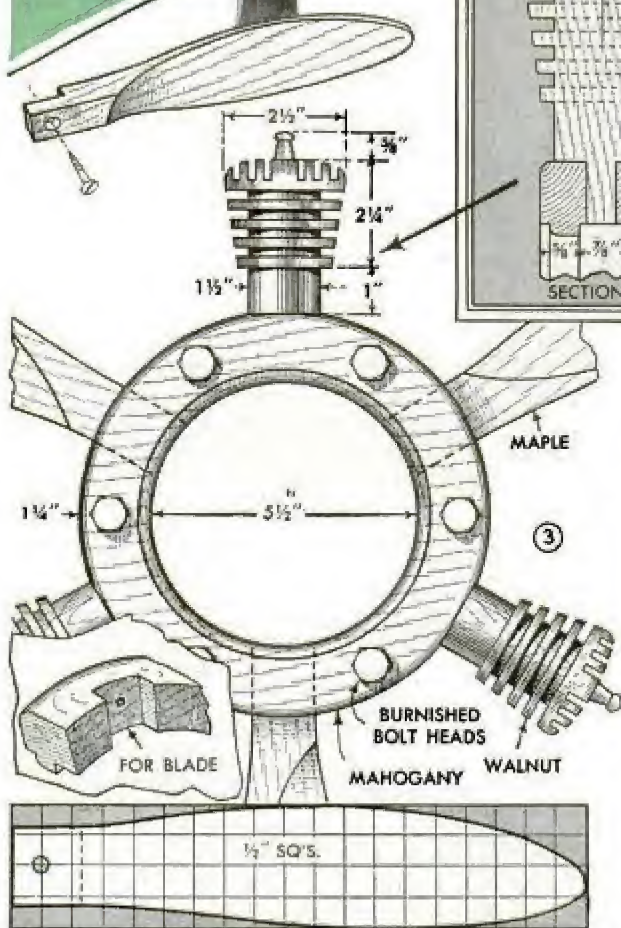
Artillery



For that photograph of your boy, you'll want a frame unusually especially designed to show his

ANYBODY would know that the airplane motor and prop shown in Fig. 1 symbolize the Air Corps, while the mobile guns in Fig. 2 instantly bring to mind the Artillery. The ring-buoy frame in Fig. 4 represents the Coast Guard, and the tank in Fig. 5 is a reminder of the "Rough Riders" of the armored forces. A ship's wheel like the one in Fig. 10 symbolizes the Navy.

The airplane motor and prop assembly consists of a ring turned of hardwood such as maple, birch or walnut, to represent a motor cowling in which are installed three propeller blades and three simple cylinders as detailed in Fig. 3. On the face, six burnished hexagon-head bolts dress up the frame. These should be brass if available, and after burnishing they are coated with transparent metal lacquer. Each cylinder is turned in one piece with a tenon on the lower end to be inserted and glued into a hole in the frame. You can turn the cooling fins on the sides of the cylinders, and use a saw to cut the horizontal ones in the top. Spark plugs are simulated with small turnings, glued in holes drilled in the cylinder heads or turned integrally with the cylinders. Flatten the





# Framed

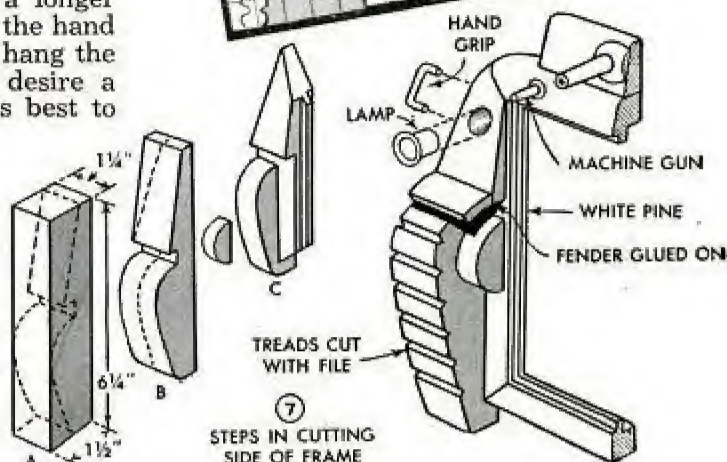
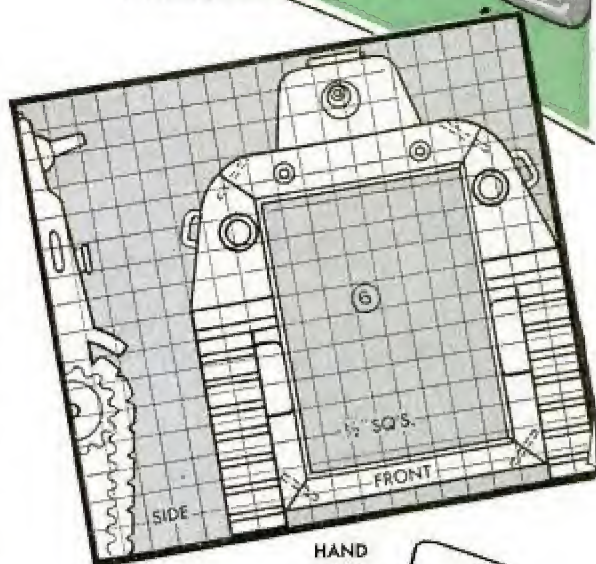


brother or friend in the service, distinctive. Why not provide one particular branch of the service?

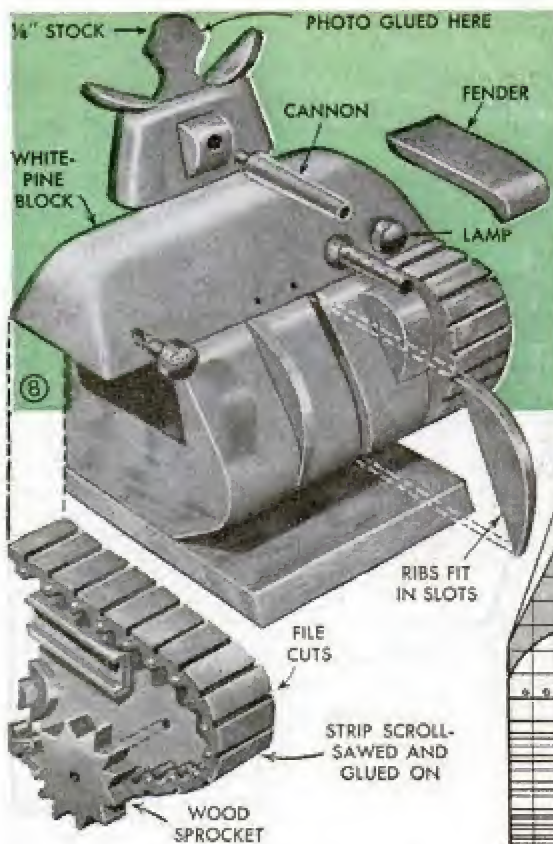
frame edge where each cylinder seats.

The frame in Fig. 2 is detailed in Fig. 11, and is a flat scrollsawed job. The conventional frame is made first, or a ready-made frame can be used. Then the gun barrels and carriages are mounted on it as overlays, only 1/8 in. thick. Over these are placed the wheels and a shield at the top. You can use clean, hard-pressed board stained and varnished to suit, or painted in colors used on artillery pieces, for the scroll-saw work, and thicker material similarly finished, for the frame.

The ring buoy for the Coast Guard, Fig. 4, is turned of softwood and has a length of cotton cord secured around the outside with brads. To this, a longer cord is bound in six places for the hand ropes, one of which is used to hang the picture on the wall. If you desire a waxed or varnished finish, it's best to turn the frame of beautifully grained hardwood, although softwood will do if the frame is to be painted. An antique paint finish looks nice on this job. The tank frame shown in Fig. 5 and detailed in Figs. 6, 7, 8 and 9, is definitely four-dimensional. A rectangular opening in front holds the portrait. Or, the front of the tank can be recessed by routing to accom-





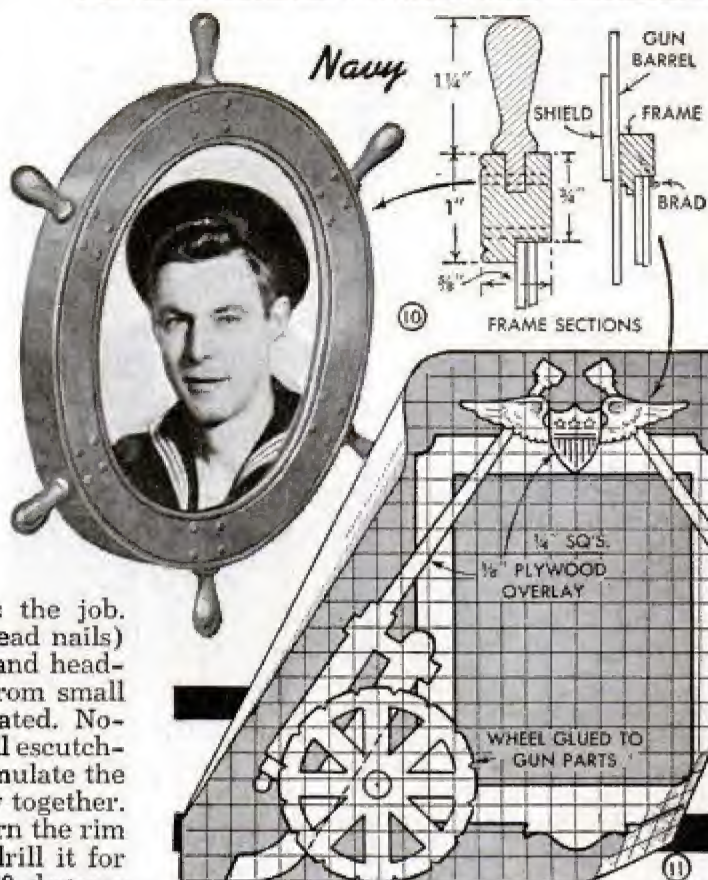
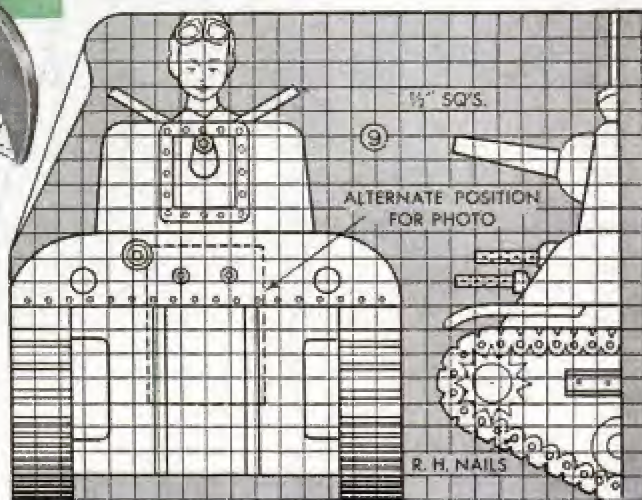


modate the picture, in which case the piece of glass or celluloid over it is held in place by light molding, this being glued on or fastened with tiny brads. Another variation is to glue the photo to hard-pressed wood or plywood and cut it out on a scrollsaw, after which the photo is mounted to appear to be coming out of the turret as shown in Fig. 9. In this case the front of the tank would be finished so that details of tank shape and the fittings on the front would be seen. Caterpillar treads are simulated by gluing built-up, scrollsawed blocks to the main block or frame as indicated in Fig. 7, notching the blocks with a file to imitate treads. Installing a wooden sprocket, channel iron and half of an idler completes the job. Short escutcheon pins (round-head nails) are used for rivet heads. Guns and headlamps can be sanded to shape from small dowels and installed where indicated. Notice that the treads also have small escutcheon pins at the outer edges to simulate the pins that hold the tread assembly together.

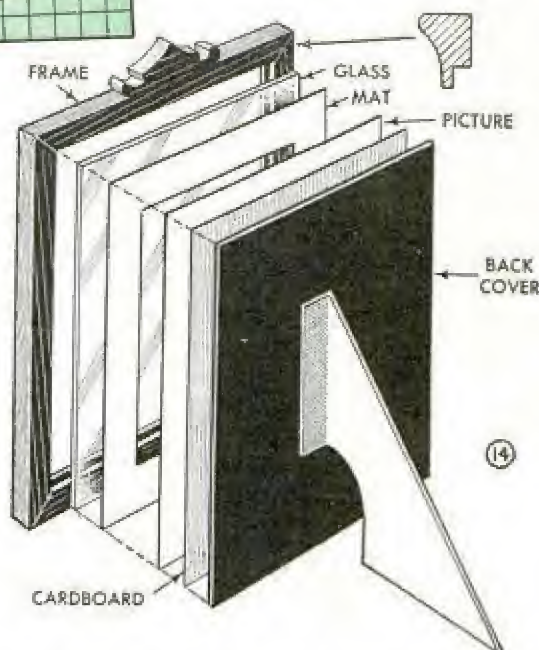
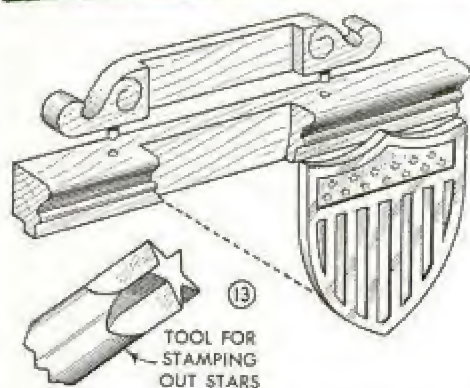
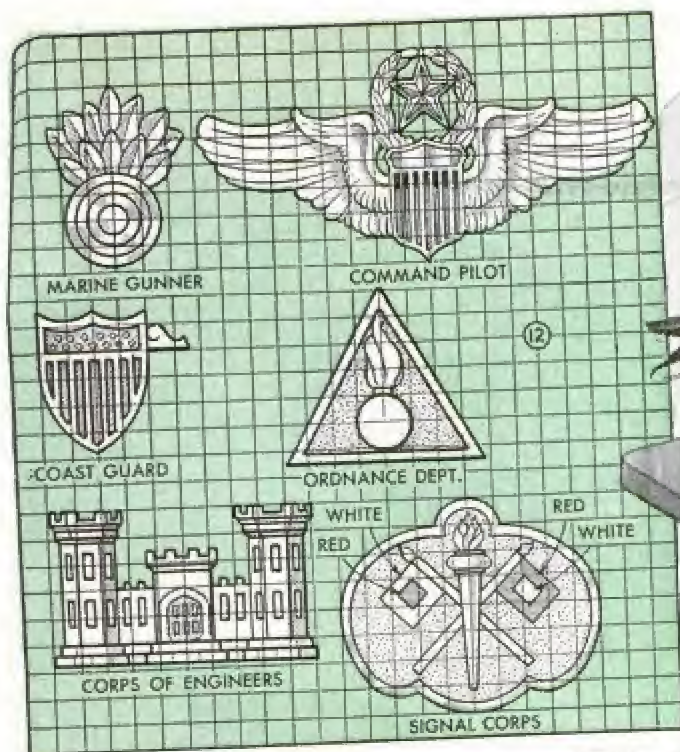
For the ship's-wheel frame, turn the rim in one piece of hardwood and drill it for six handles, which are spaced 60 degrees

apart. Use contrasting woods for the rim and handles, and insert four short  $\frac{3}{16}$ -in. dowels in the face of the rim as shown. Their purpose is purely decorative.

If your tastes are more conservative, hand-carved insignia add a smart touch to a photo framed in the usual way. These can be installed on any ready made frame, or a special one made up for the purpose. A typical assembly is shown in Fig. 14, with a cardboard easel at the back. Note that the Coast-Guard shield is set in a recess at the top of the frame with a dec-







orative piece at the back as indicated in Fig. 13. The shield is carved, and stars are formed by a stamp, which consists of a length of  $\frac{1}{8}$ -in. rod having one end filed to the shape indicated. Insignia for other branches of the armed services are represented in Fig. 12. For the Marine Gunner, hand-carved leaves surmount a disk upon which concentric rings have been turned. More elaborate is the Command-Pilot's shield with wings, a hand-carved job that requires a bit of practice.

The Ordnance Department and Corps of Engineers' insignia are also hand-carved. On the Signal-Corps' plaque, a touch of red and white paint is applied to the crossed flags as indicated in the detail.

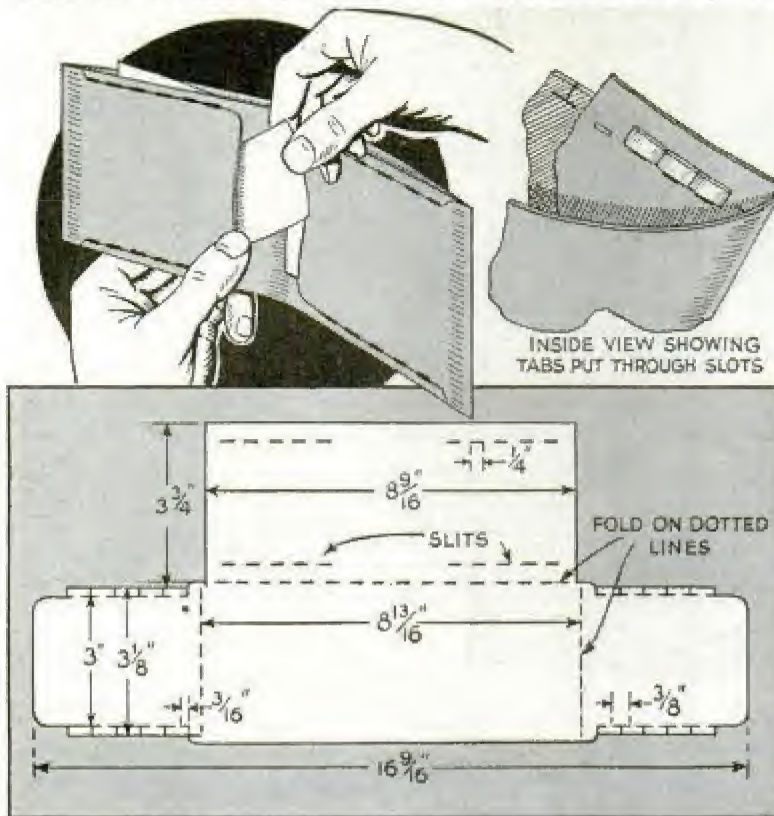
## Holes for Wood Screws Tapped to Prevent Splitting Work

When turning large screws into hardwood, which splits easily, it is a good idea to tap the hole in order to seat the screw properly and prevent splitting the wood. Before drilling the hole, measure the small diameter of the screw to be used with a pair of sharp pointed dividers and select a drill slightly larger than this measurement. After

the hole has been drilled, make a tap from one of the screws to be used, by filing or grinding flutes in it. An odd number of flutes, say five or seven, gives best results. Lubricate this "tap" by rubbing it on a piece of soap, then turn it in to full depth, using a long forward stroke, and a short back stroke, removing it from time to time.



# Thin Wallet Made From One Piece of Leather



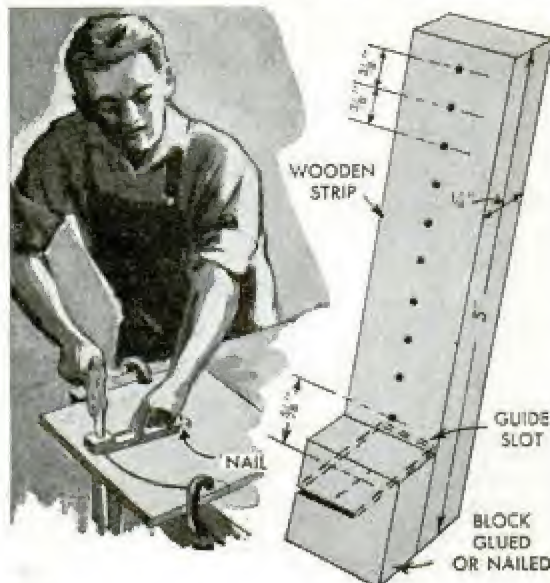
Absence of laces and stitches prevent bulkiness in this inexpensive wallet, which can be made easily by anyone. Select a piece of thin, pliable leather and cut it to the dimensions shown. On opposite edges of the two end flaps cut T-shaped tabs  $\frac{3}{8}$  in. wide. In the upper part of the leather piece, cut four rows of slots as indicated, taking care to locate them correctly so the wallet won't wrinkle when assembled. Next, fold the leather on the dotted lines, folding down the top part first, after which the end flaps are folded over it. Inserting the tabs into the slots completes the wallet, which has a place for currency and two pockets under the end flaps for cards. — Henry F. Burns, Jr., St. Louis, Mo.

## Radius Jig to Cut Bevel-Edged Disks With Keyhole Saw

Whenever you are working on a project that requires the cutting of wooden disks having beveled edges, and a lathe or power jigsaw is not available, this jig will enable you to do the work accurately with a keyhole saw. It is made from a thin wood strip, which is built up at one end to provide a suitable thickness for making a saw slot to guide the saw. In use, the saw is held in

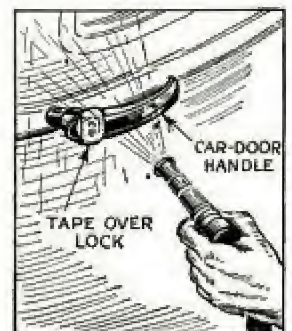
the slot, which is cut at an angle to give the desired bevel. Then a sharp-pointed instrument, to serve as a pivot, is inserted in one of the small holes shown in the piece to give the desired radius, after which the jig is held against the back of the saw with one hand to guide it in a circle while making the cut as indicated.

—W. C. Wilhite, Carlinville, Ill.

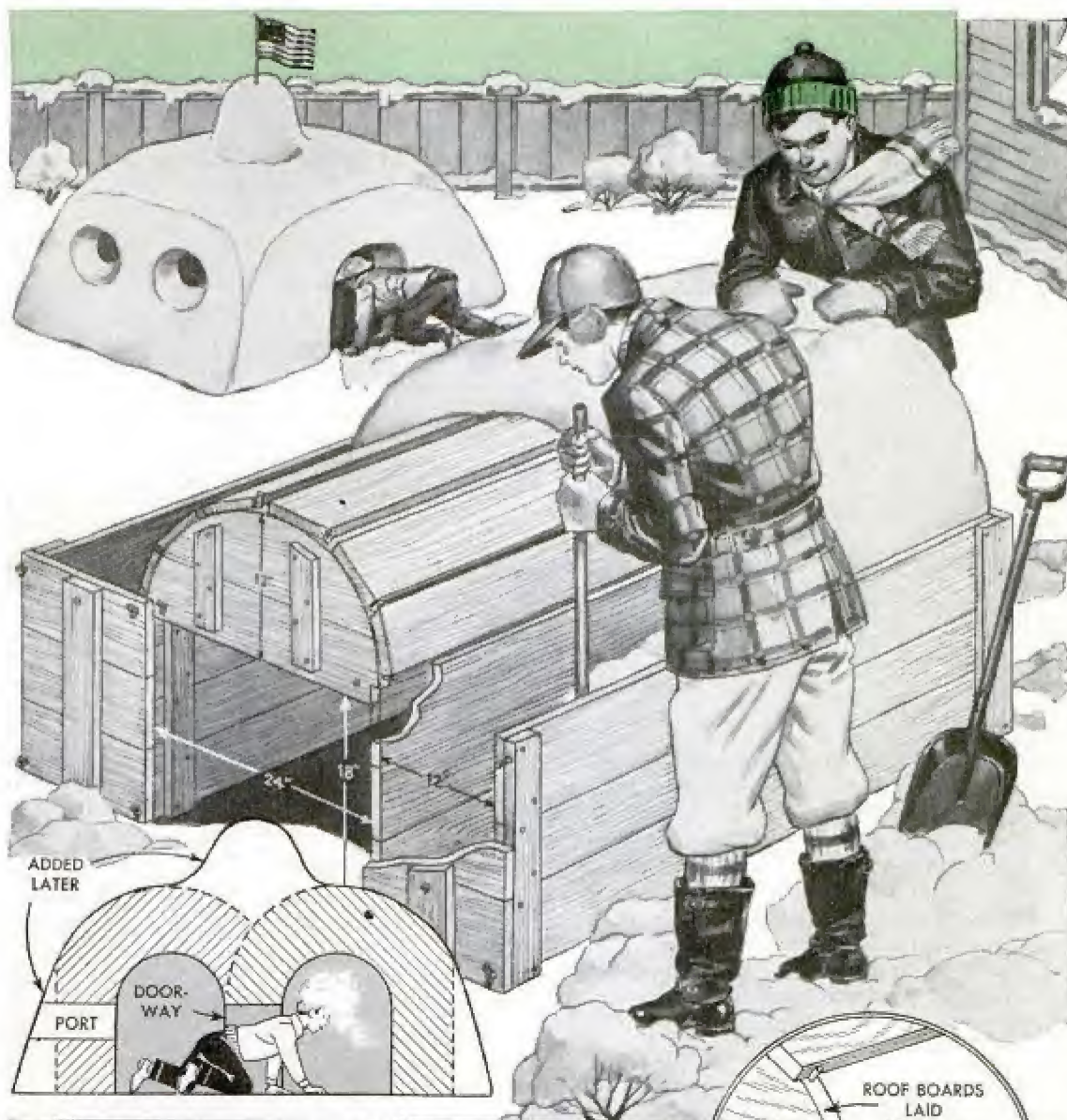


## Door Locks Kept From Freezing By Putting Tape Over Them

When a car is washed during freezing weather, or when moisture is likely to freeze in the door locks while parked, just put pieces of tape over the lock openings. This will prevent water from entering the lock, and the tape can be removed when not needed. Cellulose tape is best for this purpose, but friction tape can be used if the cellulose type is not available.







## BACKYARD IGLOOS

*"cast" on knock-down forms*

Using this simple form, the young Com-mando can set up his winter camp in the "barren regions" of his backyard or nearby vacant lot, and the boy engineers can create strong fortresses. Assembled as shown, from even the roughest material, the forms are filled with damp snow, which is packed firmly with a homemade tamper. Then snow is piled, packed and smoothed on the arched roof. The rear is closed by a form similar to that used for the sides. To dismantle the forms, end boards for the wall are removed by unscrewing the wing nuts, and the arched gable members are taken off next. This collapses the roof boards, and

the inner forms for the wall can be pulled out. The boys in the drawing are building a single form, but several single igloos placed side-by-side will make a larger unit for officers' quarters, snowball ammunition dumps and other "military" uses. If a vent is desired, it can be formed by packing snow around a section of downspout, forming a cupola. Doors in inner walls, ports and entrances are cut out with trowels before the moist snow freezes. A few old rugs or pieces of scrap linoleum will help keep the floor dry and warm.



## Simple Racks to Hold Dowel Rods Are Made From Tin Cans

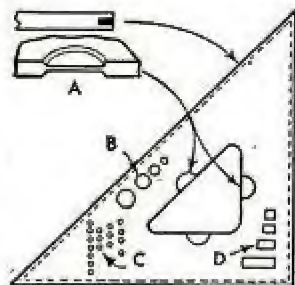


Here is a dowel rack that costs nothing to make and will hold a variety of dowels of different lengths. The rack consists of tin cans nailed to a wall, the lower cans having only the tops removed and the upper ones having both the tops and bottoms removed. By printing the dowel sizes on the upper cans, any size of dowel desired can be found instantly.

—Clarence B. Stack, Saginaw, Mich.

## Improving Artist's Triangles

By making the slight alterations shown to his triangle, one artist increased its versatility and made it easier to use. To prevent light reflections along the edges and permit speedier location of lines, he scored



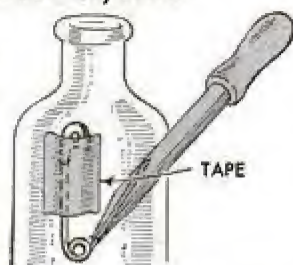
narrow grooves along all three edges and filled the scores with India ink. And for easier lifting of the triangle, he ground three recesses in the surface at the inner edges as indicated at A for

inserting a fingernail under the triangle. A number of holes of different sizes drilled in the triangle as at B will provide a means of making accurate circles around numbers, and a series of small holes of the same size as indicated at C will enable you to draw accurately spaced lettering guide

lines rapidly by inserting a pencil point and moving the triangle over the work, using a T-square as a guide. On work that requires the drawing of small boxes, you will find that three or four rectangular openings cut in the triangle as at D will enable you to do this job quickly.

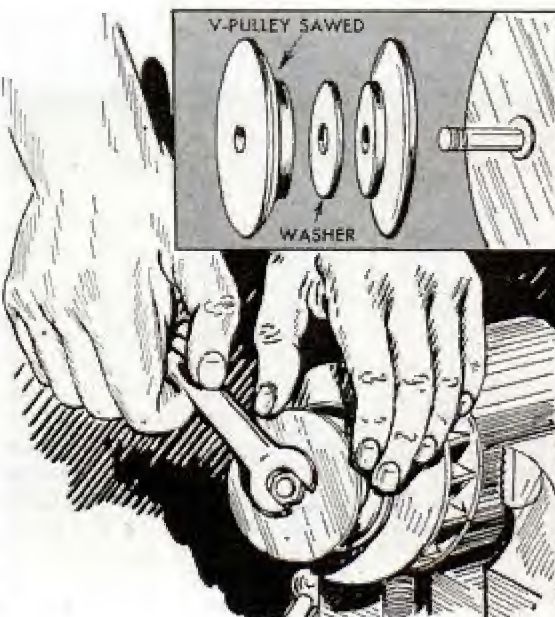
## Medicine Dropper Kept on Bottle By Small Safety Pin

Taped to the side of a medicine bottle as indicated, a small safety pin provides a handy holder for a medicine dropper. Besides this, the pin also serves to mark the bottle so that there is less possibility of the wrong one being used.



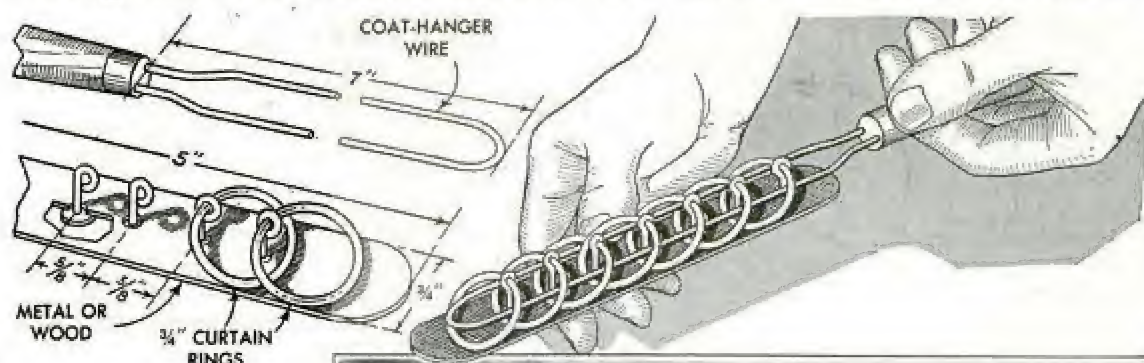
## Reducing Generator Pulley Size To Increase Electrical Output

In these days of reduced car speeds and mileage, difficulty of keeping the battery charged often can be avoided by speeding up the generator a little to increase its output. While the easiest way of doing this is to replace the generator pulley with one slightly smaller, such a pulley is not always available. In this case, the effective diameter of the regular pulley can be reduced by splitting it at the bottom of the vee and inserting a thick washer between the two halves. This allows the belt to ride lower in the vee, which decreases the diameter of the portion of the pulley in contact with the belt.—C. E. Packer, Chicago.





# Ring-and-Yoke Puzzle to Tax Your Patience



If puzzles intrigue you, here's a perplexing one to solve which seems almost impossible until you know the solution. It consists of seven curtain rings attached to a wood or metal strip through which a wire yoke is threaded as shown—the problem being to slip the yoke from the rings. Either cotter keys or soft-wire nails through oversize holes can be used to attach the rings loosely to the strip. To solve the puzzle, pass the first ring up over the end which is farthest from the handle and down through the loop of the yoke. This will enable you to slide the third ring forward, up and down through in the same way as the first. It will help you in working the puzzle to remember that a ring can be removed only when the ring preceding it is in place. In continuing, replace the first ring by sliding it up through the loop and over the end, just the reverse of the way in which it is removed, and then slip one and two down

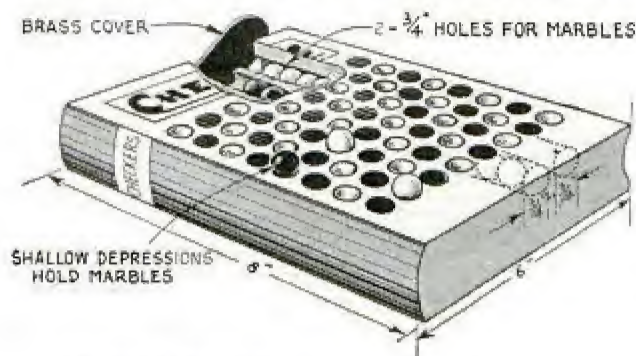


through the loop together. This permits sliding ring five forward, over and through, after which one and two are replaced by sliding them together up through the loop and over the end. Next, remove the first ring, replace the third, replace one, remove one and two, remove four, replace one and two, remove one, remove three, replace one and then remove one and two. This permits the seventh or last ring to be slipped through. Since ring five must be replaced before ring six can be removed, you must repeat the steps to replace five; that is, one and two must be slipped on the yoke, then ring one removed so that ring three can be replaced. This procedure is repeated in a similar manner until the yoke is free.

## Checkers Played With Marbles on a Book-Shaped Board

You can keep this checkerboard in a bookcase where it will be inconspicuous and always at hand. Also, it will be handy if you want to play checkers on a train trip because motion of the train will not cause the checkers to slide off the board. This is

made of solid wood, and marbles are used instead of regular checkers. When not in use, the marbles are kept in a couple of holes drilled horizontally almost through the board, brass or wood covers being pivoted over the holes to retain the marbles.



To keep the marbles from rolling when playing, shallow depressions in the surface of the board are substituted for the usual squares. You will need twelve marbles each of two colors and six or eight each of a third and fourth color for use as kings. The back side of the board can be finished plain, another game laid out on it, or otherwise treated as desired. In the original board, the book effect was further simulated with a title and scored edges to resemble pages.





## It's Fun Making BUILT-UP

By Sam Brown



**BUILT-UP** work has both utilitarian and artistic value in making lamps, boxes and similar turned work, such as those pictured in Fig. 1. The construction permits the use of average-size lumber on large turnings, and the work, if well glued, actually is stronger and more stable in many instances than solid wood. Being built up from many pieces of wood, work of this kind offers countless possibilities for pattern and color effects.

**Classes of work:** Built-up turnings can be classified in three main groups: Laminated, Segmental, and Post Blocked. Laminated, or bread-and-butter construction, is the simplest. In segment work, the turning ring is made from pie-shaped wedges of wood. Post blocked work features a central stem or post, with various layers of contrasting wood built around it.

**Selection of wood:** Wood is selected primarily for color value. The table in Fig. 4 gives a typical selection of light, medium and dark woods, scaled in order from lightest to darkest. Two-color pattern effects

### Laminations

"BREAD-AND-BUTTER" CONSTRUCTION IS THE SIMPLEST METHOD OF MAKING BUILT-UP TURNINGS

CENTER CUT OUT TO SIMPLIFY TURNING

GRAIN IS CRISS-CROSSED ON ALTERNATE LAYERS



④ SELECTION OF WOOD FOR COLOR			
	WOOD	COLOR	HARDNESS
LIGHT	HOLLY	VERY WHITE	MEDIUM
	BASSWOOD	VERY WHITE	VERY SOFT
	MAPLE	WHITE-PINK	HARD
	WHITE PINE	WHITE-YELLOW	SOFT
	BIRCH	WHITE-BROWN	MEDIUM
MEDIUM	GREENHEART	GREEN-YELLOW	HARD
	BUTTERNUT	LIGHT BROWN	SOFT
	MAHOGANY	RED-BROWN	MEDIUM
	RED GUM	RED-BROWN	MEDIUM
	CHERRY	RED	MEDIUM
DARK	WALNUT	BROWN	MEDIUM
	PURPLEHEART	PURPLE	MEDIUM
	ROSEWOOD (EAST INDIAN)	PURPLE-BROWN	HARD





# TURNINGS

usually are based on a white wood, such as holly or maple, combined with dark wood, such as gum, cherry or walnut. The wood should be of even color, sound, free from sap or mineral streaks. Hardness also should be considered, as best results are obtained when the woods used in the build-up possess approximately the same degree of hardness. Any hardwood will turn well alongside any medium hardwood. Any medium wood can be combined with any softwood. Softwoods should not be combined with hardwoods except in the case of thin spacers for laminated work. In all other instances the use of softwood alongside hardwood will cause the work to turn out-of-round, and sanding will develop positive flats.

**Laminations:** The build-up for this type of work is made from solid rings or squares of wood glued together face to face, as shown in Fig. 2. The only principle that need be observed is that the grain in alternate layers should be at right angles, Figs. 3 and 5, in order to equalize shrinkage-and-warping strains. The grain of thin 1/8-in. spacers need not be considered. Turning time is saved if the individual rings are cut to the approximate circular shape inside and out before assembly.

**Segments:** Many novel pattern effects are possible by using segments, some of the most complex build-ups being quite simple. Fig. 6 is a typical example. While this appears to be a complex bit of work, it really is easy to do. First, a cylinder is made up from maple and walnut wedges,

## Segments

THE SOLID-SEGMENT FORM IS IDEAL FOR LAMP BASES, BOX LIDS AND SIMILAR WORK

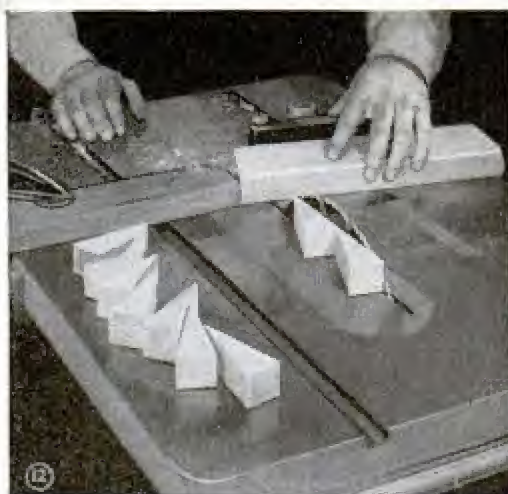
DIAMETER OF TURNING CIRCLE

LENGTH OF SIDE

EXAMPLE 3" DIA. 8 SIDES FROM TABLE. SIDE = 1 1/4"

DIA. OF TURNING CIRCLE	NUMBER OF SIDES									
	8	10	12	14	16	18	20	24	30	
2	2 7/32	2 1/32	1 7/32	1 5/32	1 3/32	3/8	5/16	9/32	7/32	
2 1/2	1 1/16	1 3/16	1 1/16	1 3/32	1 1/2	1 5/32	1 3/32	1 1/32	9/32	
3	1 1/4	1	1 1/16	1 1/16	1 1/32	1 1/32	1 1/2	1 1/32	5/32	
3 1/2	1 15/32	1 5/32	1 5/16	1 13/32	1 23/32	5/8	9/16	1 5/32	3/8	
4	1 23/32	1 5/16	1 3/32	1 5/16	1 13/16	2 3/32	2 3/32	1 7/32	7/16	
4 1/2	1 7/8	1 13/32	1 7/32	1 1/32	1 29/32	1 13/16	2 3/32	1 19/32	1/2	
5	2 3/32	1 9/16	1 11/32	1 13/32	1 29/32	1 29/32	1 13/16	2 1/32	1 13/32	
6	2 1/2	1 13/16	1 5/8	1 13/16	1 13/32	1 13/16	2 3/32	2 5/32	2 1/32	
7	2 23/32	2 3/32	1 7/8	1 13/32	1 13/32	1 1/4	1 13/16	2 1/16	3/4	
8	3 5/16	2 5/8	2 3/32	1 23/32	1 13/32	1 13/16	1 9/16	2 1/16	2 3/32	
9	3 3/4	2 13/16	2 1/16	2 1/16	1 13/16	1 13/32	1 13/16	2 1/16	3 1/32	
10	4 5/32	3 1/4	2 11/16	2 3/8	2	1 25/32	1 13/32	2 1/16	1 1/16	
12	5	3 23/32	3 3/32	2 3/4	2 13/32	2 1/8	1 23/32	1 13/32	1 9/32	
14	5 13/16	4 9/16	3 3/4	3 3/8	2 25/32	2 15/32	2 3/32	1 23/32	1 1/2	
16	6 5/8	5 3/16	4 3/32	3 21/32	3 3/16	2 25/32	2 13/32	2 1/8	1 11/16	



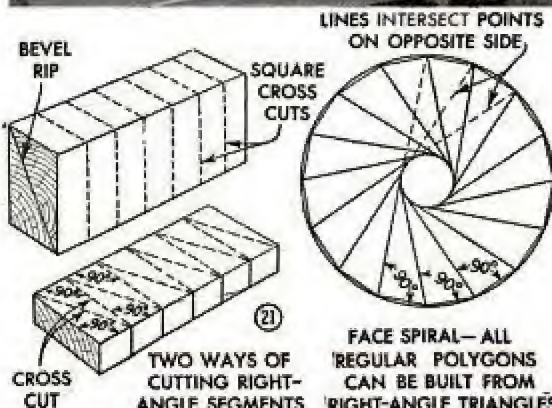
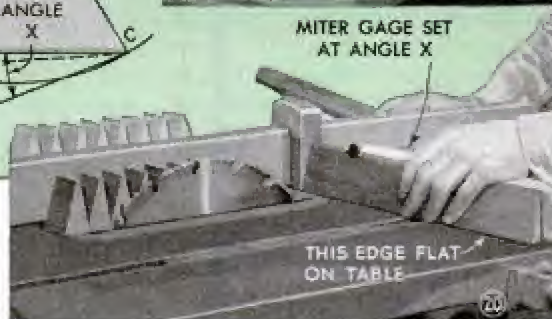
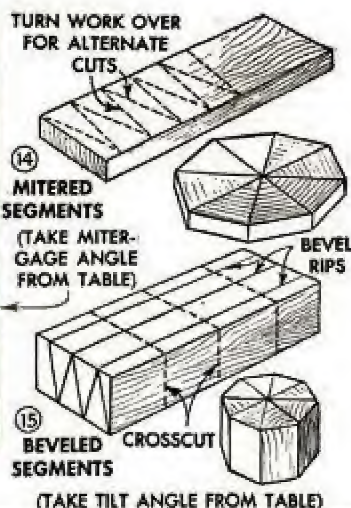
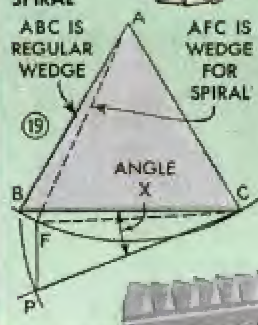
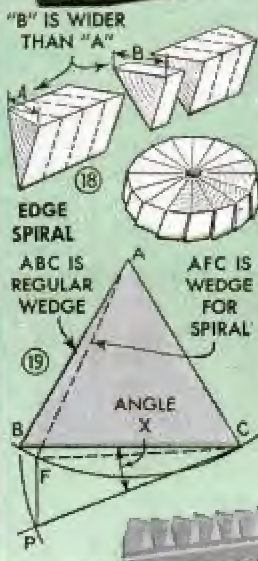


**13 MITER GAGE AND TILT-TABLE ANGLES FOR REGULAR POLYGONS**

SIDES	MITER GAGE	TILT TABLE
6	60	30
8	67.5	22.5
10	72	18
12	75	15
14	77.15	12.85
16	78.75	11.25
18	80	10
20	81	9
24	82.5	7.5
30	84	6

### Cutting

ILLUSTRATIONS ON THIS AND OPPOSITE PAGE SHOW FIVE METHODS OF CUTTING "PIE" SEGMENTS SUITABLE FOR LAMP BASES, BOX LIDS, ETC.

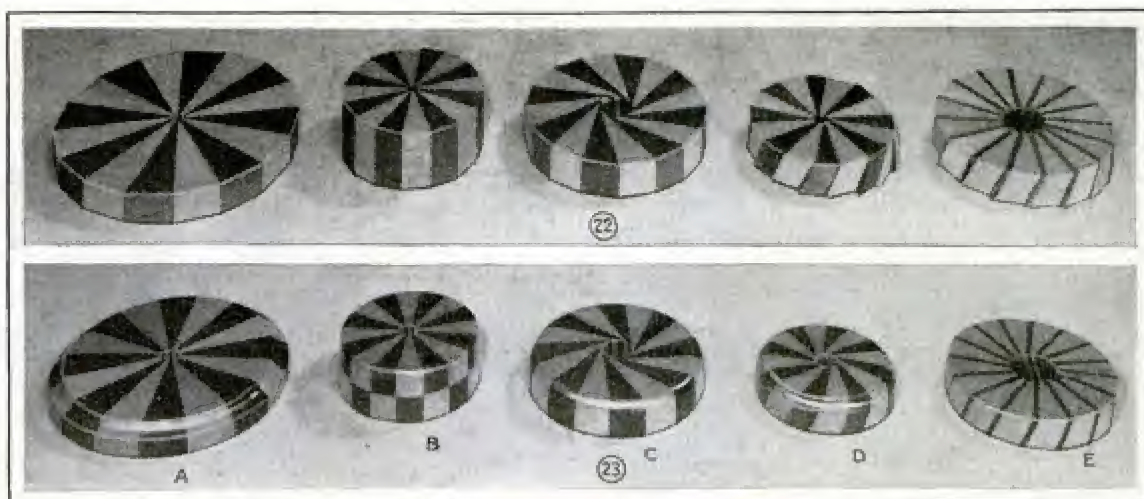


as shown in Fig. 10. The cylinder is rough-turned, Fig. 8, and slices are then cut off on the circular saw, as shown in Fig. 9. These slices can be stacked and glued in checkerboard style, as indicated in the foreground, Fig. 9, or succeeding rings can be rotated slightly to break the joints, as illustrated by the lamp, Fig. 6. The plain cylinder itself produces the effect shown by the box in Fig. 7. In all cases, the cylinder can be turned to any desired shape without affecting the arrangement of the pattern.

**Size and cutting angles:** First consideration in making a built-up segment turning must be given to the size and shape of the wedges required. The matter of size is simplified by the table in Fig. 11. Just run down the left-hand column until you find the required diameter of work, and then, under the number of sides, you will find the side length in inches of the segments. For example, 5-in. diameter, 16 sides, requires segments 1 in. wide. The matter of cutting requires either swinging the circular-saw miter gage, or tilting the table, taking the angle from the table in Fig. 13.

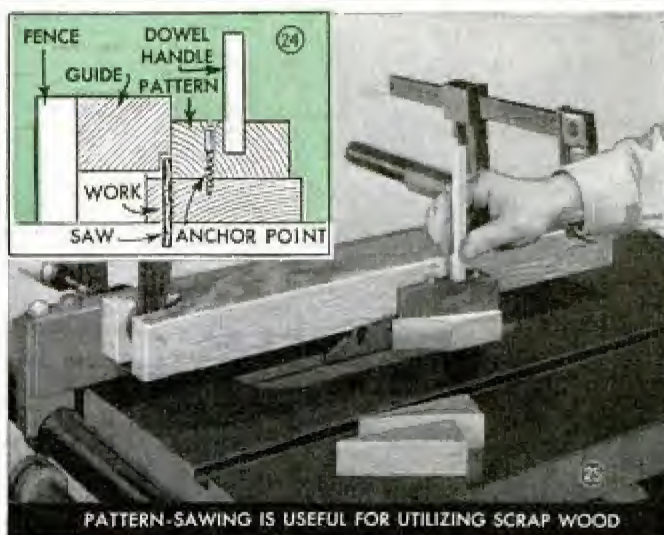
**Cutting:** The simplest way to make flat assemblies for bases and box lids is to swing the miter gage, Fig. 12. Fig. 14 shows how the pie-shape wedges are cut without waste by alternately turning the work over. Segments cut in this manner will show the grain running round-and-round. Following out the example, (5-in. diameter, 16 sides) the base of each segment will measure 1 in., and the direct miter-gage setting will be at  $78\frac{3}{4}$  degrees (from table, Fig. 13). The width of the work will, of course, be one-half the diameter ( $2\frac{1}{2}$  in.). Another





way of cutting is to bevel-rip the work at the required angle, taking the tilt setting from Fig. 13. Fig. 15 shows this method of cutting. Note in this instance that the grain of the wood runs up-and-down. If wedges are ripped from wide stock in this manner, a stop block should be used as in Fig. 16, to gage the set-over. Fig. 17 shows the long strips being crosscut into shorter lengths.

**Spirals:** Segment work can be assembled to show a spiral on either the edge or face. The edge spiral, Fig. 18, is cut by using an angular miter-gage setting when cutting off short lengths from a long, bevel-ripped wedge. Fig. 20 shows the operation, a good effect being obtained with a spiral angle of 15 to 25 degrees. Since angle cutting changes the width of the wedge, as can be seen in Fig. 18, the original wedge shape must be altered to suit. The easiest way to determine the size is to make a simple drawing, Fig. 19. Lay out a triangle ABC of the size and shape required for a straight assembly, or cut out a standard wedge and trace around it. Then from point C lay out the spiral angle of from 15 to 25 degrees, as indicated by angle X. With center C and radius CB, strike an arc intersecting the angle line at P. Project P to the circle of the triangle at F. AFC is the size wedge required for the spiral assembly. If you prefer trial-and-error methods instead of the layout, simply rip the wedges about  $\frac{1}{16}$  in. narrower than normal. In our previous example (5-in. diameter, 16 sides) make the base of the wedge  $1\frac{1}{16}$  in. instead of 1 in. Then, angle a line across the wedge so that the line will be 1 in. long. This angle will be the cutoff line, and the miter gage can be set accordingly. All this is harder to describe than do—you will find it quite sim-



PATTERN-SAWING IS USEFUL FOR UTILIZING SCRAP WOOD

ple when you start doing the actual work.

The face spiral, Fig. 21, shows a spiral design on the face of the work. This spiral is based on right-angle triangles, and all regular polygons can be built from the right-angle triangle. The simplest way to determine the shape is to lay out a full-size circle of the diameter required, dividing this into the number of pieces desired. Erect lines at right angles to the sides of the polygon to arrive at the shape of wedges required. You will notice that the right-angle lines, if projected across the circle, will intersect points on the opposite side, thereby simplifying the layout.

**Pattern sawing:** Sawing wedges with the use of a pattern can be employed to advantage in utilizing scrap pieces of wood. A pattern of the required wedge is first made up in hardwood and fitted with a handle and anchor points. It can be seen, Figs. 24 and 25, that if the pattern is fixed to a scrap piece of wood, the work can be cut to the same exact shape as the pattern by guiding the pattern along the wooden guide. This technique is much slower than





WORK IS TURNED OVER FOR ALTERNATE CUTS

SEGMENTS CUT BY TILTING TABLE

BEVEL RIP

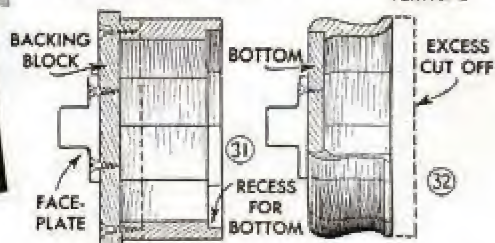
SEGMENTS CROSS CUT AFTER BEVEL RIPPING

GRAIN IS HORIZONTAL

GRAIN IS VERTICAL

## Segment ring

THE SEGMENT RING PERMITS MAKING LARGE BOWLS AND BOXES FROM CONVENTIONAL LUMBER STOCK



A  
MONOTONE, CUT FROM ONE RING



B  
ALTERNATE LIGHT AND DARK WOOD



C  
CHECKERS, CUT FROM RING "B"



D  
STEPPED, CUT FROM RING "B"



E  
DARK WOOD WITH LIGHT 1/8" SPACERS



F  
TOP RING, WALNUT CENTER, MAPLE



G  
1/8" SOLID SPACERS BETWEEN RINGS



H  
SPIRAL IN LIGHT AND DARK WOOD



I  
LAMINATED FROM RINGS "B" AND "H"

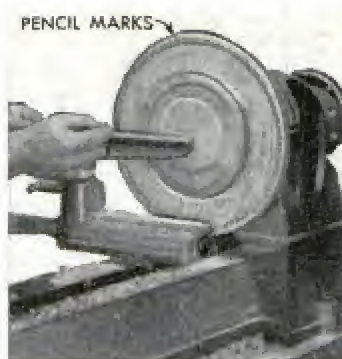


J  
RIGHT AND LEFT HAND SPIRALS

regular cross cutting or bevel ripping. Also, it should not be attempted on wedges less than 1-in. base and a 2-in. length. Despite these drawbacks, pattern sawing is often useful, since wedges can be cut from scraps from band or jig-saw work. A, in Figs. 22 and 23 was cut by this method, the two views showing the segments as cut and then turned. The other examples in these photos are: B, bevel-ripped wedges cut in two after assembly and rotated to form checkers; C, face spiral; D, edge spiral; E, edge spiral with 1/8-in. spacers. Spacers can be introduced into any assembly without affecting the cutting angles. It should be noted, however, that spacers increase the size of the work and also increase the size of the opening.

**Segment rings:** Very often it is desired to make the segment build-up a ring instead of the solid "pie" previously described. In this event the work is cut from flat stock. The cutting angles are the same as before since the segments are simply the outside portion of a full pie-shaped wedge. Segments of this kind usually are cut by tilting the saw table, as shown in Figs. 28 and 29, the grain in the assembly running round-and-round. Also, segments can be cut by straight cross cutting after bevel-ripping, Fig. 30, in which case the grain in the assembly is vertical. The simplest method of turning

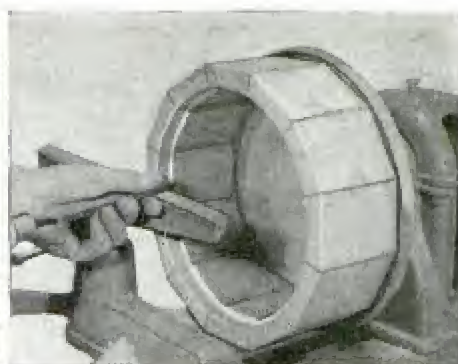




First: Backing block faced and guide lines marked



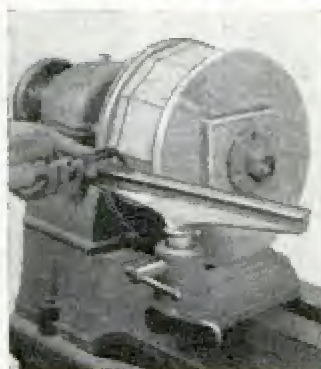
Second: The segment ring is glued on the backing block



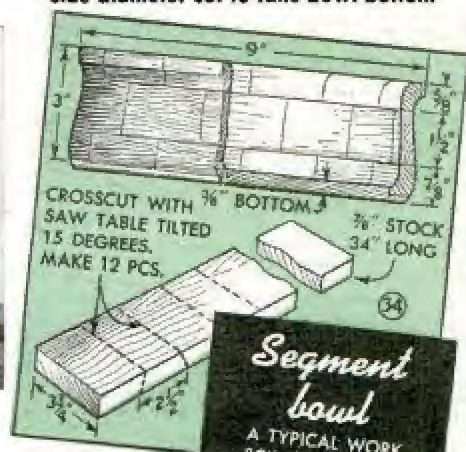
Third: Recess of largest possible inside diameter cut to take bowl bottom



Fourth: Bowl bottom turned to fit recess in segment ring



Fifth: Ring glued to bottom and a 3/4-in. ring marked off

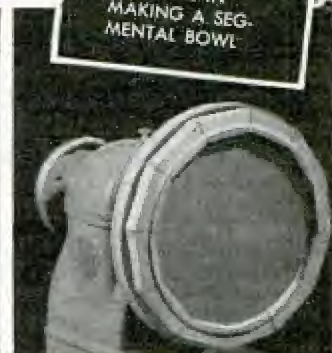


the assembly is to make the work a little longer than required to take the screws from a backing block, Fig. 31. Mounted on this block, the recess for the bottom of the bowl or box can be cut. After fitting the bottom, the work can be rechucked, turned, and the excess material cut off, Fig. 32. Figs. 26 and 27 are examples of segment-ring work, while Fig. 33 shows various ways in which the segment ring can be manipulated to form pattern effects.

**Segment bowl:** A typical schedule of operations in making a segment bowl is shown by the photos on this page and in Fig. 34, which gives the dimensions of the bowl. The construction style is a three-layer monotone cut from a single 12-piece segment ring. Referring to Table Fig. 11, it can be seen that a 12-side polygon to turn 9 in. diameter should have sides  $2\frac{7}{16}$  in. long. Since the exact bowl size is not critical, the segments can be cut a little oversize,  $2\frac{1}{2}$  inches. The segments are cut by tilting the saw table, taking the tilt angle from Table Fig. 13, which shows that a 12-side polygon requires a



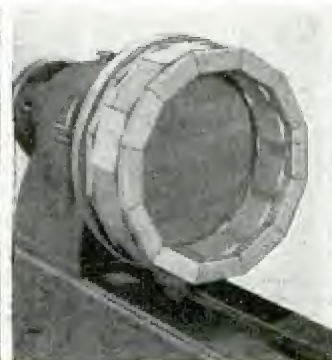
Sixth: Work is cut through with saw while on face-plate, lathe being turned off



Seventh: Base segment ring is faced off square; inside is rough-turned if desired

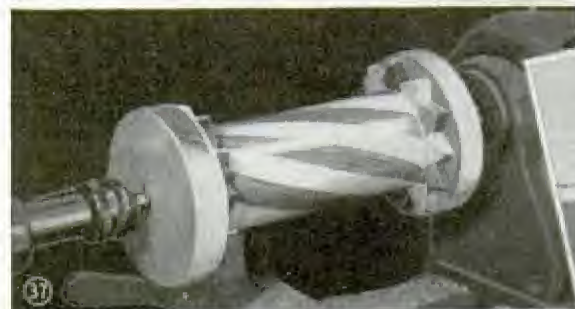


Eighth: Carefully centered, the segment ring is reglued, being sure to break joints

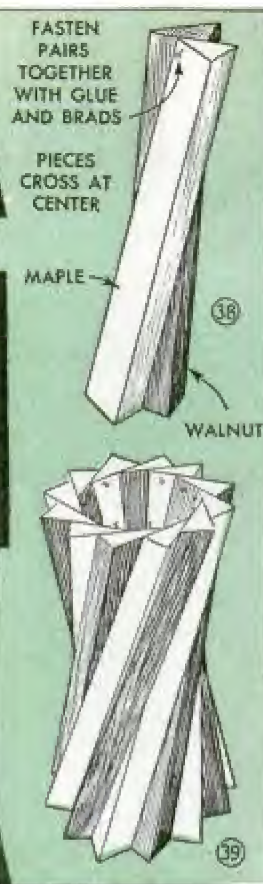


Ninth: Other rings are cut and glued in the same manner to give the final build-up





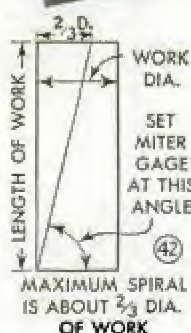
*The long spiral*  
SPIRAL-TURNED WORK CAN BE PRODUCED FROM STRAIGHT LUMBER BY USING THE BUILT-UP METHOD SHOWN HERE



tilt table setting of 15 degrees. After cutting, the segments are glued up by wrapping with twine or soft wire. The photos and captions take up the schedule at this point and carry it through to the final stages of the build-up, after which the work can be turned to shape. After completing the first step, the segment ring must be centered on the block before gluing it.

**The long spiral:** Some peculiarities arise when the edge spiral previously described is built up in lengths over 3 or 4 in. Basically the work is the same as the short-edge spiral, the wedge shape being determined in the same manner, Fig. 19. Fig. 36 shows the wedge strips being cut to length at the required spiral angle. Assembly is made by gluing and braddding pairs together, Fig. 38, and then assembling the pairs to form the complete build-up, which gives the rather odd-looking shape shown in Fig. 39. Extra length should be allowed so that the work can be turned without running into the brad fastenings, Figs. 35 and 37. Fig. 40 shows the finished work and Fig. 41 indicates how slices can be cut from the original cylinder and stacked checkerboard style. The long spiral has limitations and works out best with a moderate spiral angle. The maximum angle is about two-thirds the diameter of the turning and can be determined by making a simple drawing of the work, as shown in Fig. 42.

(To be continued)



## Quick Method of Fitting Paper Accurately in Drawers

Fitting clean paper into drawer bottoms is simplified if the drawer is taken out and inverted. On most drawers the outline of the space to be fitted is apparent on the bottom, so that if the paper is folded to fit this outline, it will fit the drawer exactly. If the paper has a pattern, it must be placed with the pattern down against the bottom of the drawer while being folded so that the pattern side will be up when the paper is in place.

—Alton Jezowski, Hamtramck, Mich.

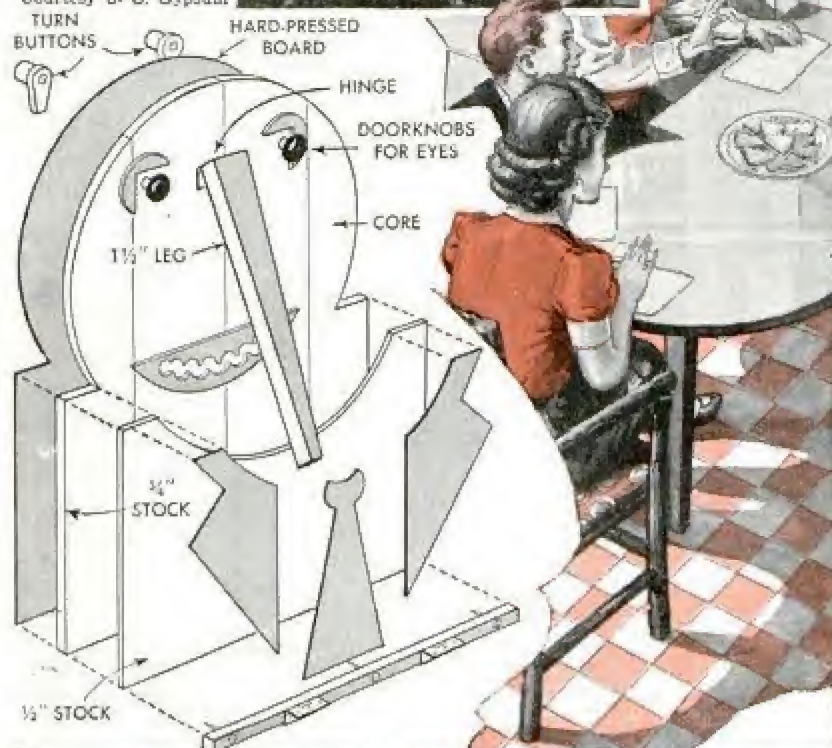


# RUMPUS-ROOM TABLE

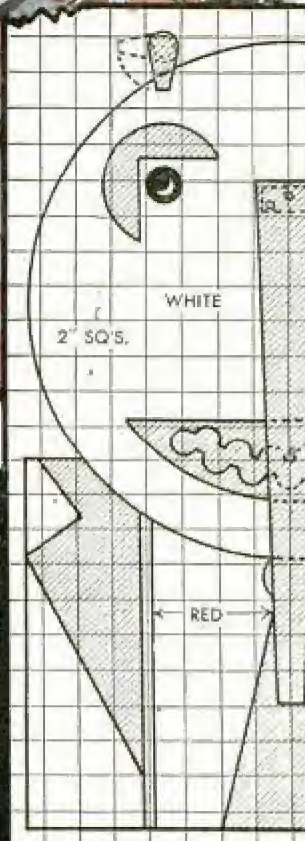
*folds flat against wall*



Courtesy U. S. Gypsum



Besides its space-saving feature, this novel table when folded flat against the wall will add a comical touch of decoration to your basement recreation room. Plywood, if available, simplifies construction, but where this cannot be had, tongue-and-groove stock, glued edgewise, will do for the core, which is faced on one side with hard-pressed board to provide a smooth top. Lapels, tie, mouth and eyebrows are of hard-pressed board also, the lapels and tie being attached to a 1/2-in. panel which in turn is fastened to the lower half of the core as shown above. Old doorknobs are used to represent eyes, while the hinged support produces a comical nose. The table is hinged to a cleat screwed securely to the wall, the hinges being set flush in both the cleat and the edge of the table. Two turn buttons hold the table folded against the wall





## Clip Attaches Badge to Clothing Without Damaging Fabric

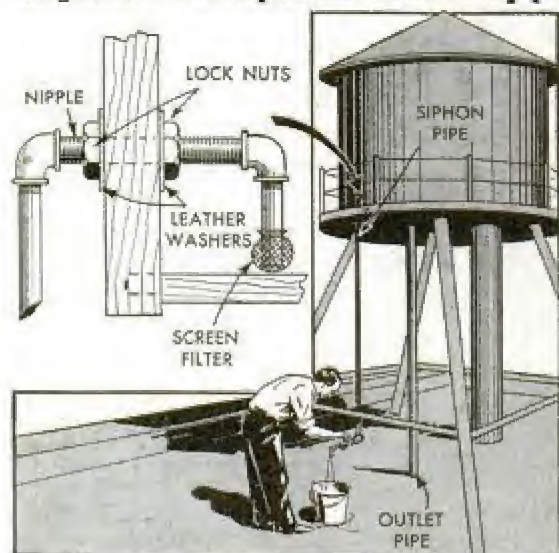


Of the many methods devised by war-plant workers for attaching their badges to protect their clothing, this is one of the simplest and most practical. A clip of thin, springy metal is shaped as shown to slip over the regular pin on the badge, after which attaching the badge to the clothing is just a matter of inserting the clip into a lapel buttonhole, or slipping it over a shirt pocket or garment belt. As no holes are made in the cloth, it is not damaged.

—Roland Swedlund, Buffalo, N. Y.

## Combination Drain and Siphon For Large Water Tank

The problem of completely draining a large water tank in which the discharge fittings projected upward 3 or 4 in. inside the tank, was solved by a small siphon arrangement. The siphon consists of a pipe

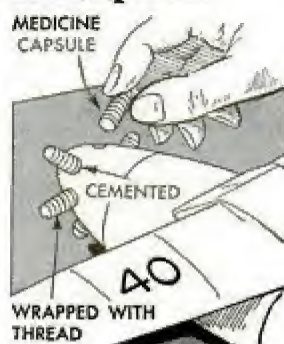


assembly as shown in the detail, the discharge pipe running almost to the ground where a shut-off valve is provided. The upper end of the siphon comes to within about  $\frac{1}{4}$  in. of the tank bottom and is fitted with a screen filter to prevent clogging.

—L. B. Robbins, Harwich, Mass.

## Model-Airplane Motor Cylinders Imitated With Capsules

Instead of tediously carving imitation cylinders from wood to simulate the motor of a model airplane, one hobbyist uses empty medicine capsules. Obtainable in various sizes, the capsules are merely glued around the shaped



nose of the plane as indicated. Spaced wrappings of fine thread around the capsules give the appearance of cooling fins.

## Vacuum Cups Will Stick Better If Coated With Nail Polish



If you experience difficulty in making a vacuum cup stick to a surface that is slightly rough, coat the lower edge of the cup with nail polish and immediately press it into place. Hold the cup depressed for a moment until

the polish dries. This provides an airtight seal for the cup, which can be removed when desired by prying it loose with a thin knife blade.

## Emergency Photo Stand of Wire

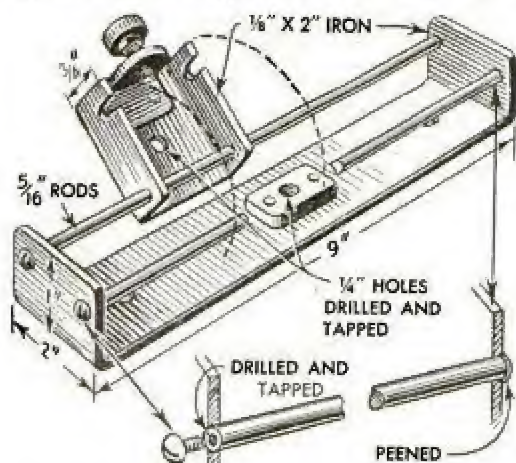
When you need a temporary stand to support a photo, one can be made quickly and inexpensively from a length of wire bent as shown. Such a stand also is handy for supporting small mirrors and similar items when a regular stand for the purpose is not at hand.



—Don Richard, Manchester, N. H.



# Twin Tripod Head Aids Short-Distance Focusing



If you have had the unpleasant experience of losing the chance to take a good picture simply because time was wasted in moving the tripod a few inches to a more desirable position, you will appreciate this tripod head. It allows the camera to be moved as much as 7 in. without altering the position of the tripod, which makes it especially handy for close-up shots where critical focusing is an absolute necessity. Also, such a head can be used to mount two cameras side by side for stereoscopic purposes or when taking movies and snapshots at the same time. By adjusting both cameras to include the center of the same field of vision, one view finder will suffice for both cameras, permitting the use of either or both of them at critical moments of action. As shown in the detail, the head consists of a base carrying two iron rods on which a small tilting platform slides, the tilting arrangement being necessary for easy attachment of the camera. The base is drilled and tapped centrally for the tripod screw, a small metal block being riveted to the base to provide plenty of space for threads. The platform is drilled and tapped for the screw that holds the camera. A thumbscrew on the platform permits it to be tightened securely against one of the rods. When two



cameras are used, it will be necessary to have an extra head, which is slotted to fit over both rods for easy removal, a thumbscrew being used to hold it in the same way as with the regular platform.

—Lorin Anderson, Denver, Colo.

## Lipstick Case Provides Protective Cover for Pocket-Size Dusting Brush



An excellent pocket brush for cleaning dust particles from lenses, cameras and negatives can be made by mounting a small camel's hair brush in a lipstick case. Use a discarded case of the type that expels the lipstick when the base is turned and remove all the old lipstick with tweezers and a piece of tissue. Cut off the handle so the brush fits in the case and hold it in place while plaster of paris is poured around it. The plaster will set quickly, after which the case can be laid aside for a short time to allow it to dry thoroughly.—John Karlovic, Chicago.





# LIGHTING



*By Fred G. Korth*

**G**OOD lighting is of utmost importance in getting good photos. Assuming that you make an exposure according to a chart or an exposure meter, that you develop the film as suggested by the manufacturer, and follow the common practice in printing, it is the lighting and the posing which make or break the picture. A conventional pose for conventional purposes requires more or less conventional lighting, while an unusual pose of the subject and an unusual viewpoint of the camera generally require unusual lighting. There are no hard and fast rules for lighting that will guarantee good results, just as there are no hard and fast rules for composition or camera angle. Many of the most striking shots seem to violate all of the so-called rules of lighting, composition and viewpoint.

The safest method to arrive at good indoor lighting is to take the main light and move it around until the effect is pleasing. Sometimes you can stop right there. However, almost every beginner is apt to overlook the depth of the shadows resulting from using one light, finding later that the pictures do not come up to par because of the inky shadows. So, it is better in most cases to improve the effect with a secondary light, and others if needed. In using lights, remember not to switch on several at a time. On the contrary, find out exactly

what each light will do by turning off all the others for a moment. This is the way to avoid using too many lights. The fewer used the better. Another thing to watch out for is cross shadows. No matter how many lights you use, see to it that only one set of shadows will show—those caused by the main illumination—in order to give the scene a natural appearance. The reason for avoiding cross shadows is that they are unnatural as there is but one sun, and cross shadows are unknown in nature. The same is true of highlights. No matter how many areas you illuminate with various lights, one should be brighter than all the others together. However, like all general rules the one on eliminating cross shadows and using a predominant main light applies only to conventional pictures which are supposed to look natural. Odd and bizarre photographs often have greater attention values, and their lighting is governed entirely by different principles.

Now, in applying good lighting when making portraits indoors, such as the one shown in Fig. 1, your main object is to obtain a good likeness of the subject in a pleasing manner. No doubt a more dramatic photo could be made of this man by posing and lighting him differently, but the method to follow generally is one that produces a picture which will be most likely



# for Better Photos .....



③

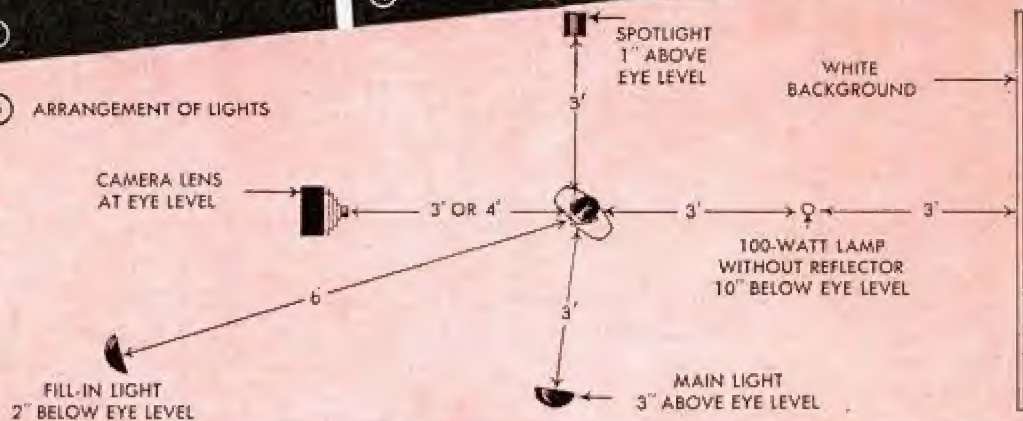


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## ⑥ ARRANGEMENT OF LIGHTS



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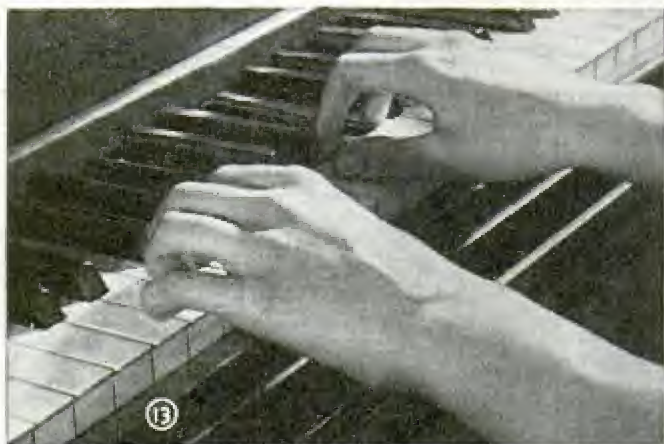


⑨



⑩





to satisfy him and his family. The photo shown in Fig. 1 required four lights placed as indicated in Fig. 6. Fig. 2 shows the effect of the main light alone. After the pose had been decided, this light was placed high enough to throw a shadow under the chin, yet low enough to "highlight" the eyes—note the small white dot in each eye which you get from the main light. The far side of the face should be illuminated entirely but only a portion of the side nearest the camera, leaving this side almost entirely in shadow. The secondary light must strike the shadow side of the face without

over-emphasizing the ear, the latter being an important point to remember. A small spotlight with a frosted bulb was found best to use as a secondary light in this case. Fig. 3 illustrates the effect of the spotlight alone, focused at the cheek in front of the ear. Both of these lights used together might suffice for a character study. But the head has not yet been outlined sufficiently against the background, and the shadows in the eyes, ear and under the chin are still too deep. Therefore, a third light was placed somewhat below eye level and far enough away as indicated in Fig. 6 merely to give some detail in the shadows. This third, so-called "fill-in" light when used alone renders a picture like Fig. 4. Note how it lightens the background. The effect is flat, similar to shots made with a synchronized flashlight attached to a camera. Finally we can improve this portrait with a fourth light for the background. The effect of which, when used alone, is shown in Fig. 5. It is simply a 100-watt lamp without a reflector, set low behind the sitter's head about midway between him and the background. There are two reasons for using a lamp here without reflector. A reflector might be too big and it might show, particularly if he should move slightly, and a reflector does not allow the light to fade evenly in all directions on the background.

To make an outdoor portrait of this man in the same pose you would proceed along similar lines. First, you would select a day with hazy sunshine when the sun is not too high, so that it could strike at about the same angle as the main light did in Fig. 2. You would select a neutral background far enough removed so that its detail would not be rendered sharply. White cards or tinfoil reflectors could be used to simulate the effects of the secondary and fill-in lights. With sand or white walls surrounding the subject, special reflectors would be unnecessary because sunlight would be reflected from these surfaces to fill in the shadows. Sunlight is the best light, but it is not as desirable for photography and not available at all times. Therefore, studios use electric light for most purposes.

Problems of still-life lighting are illustrated best by making use of a plaster cube





for a subject as shown in Figs. 7 to 10 inclusive. The principles involved can be applied to photographs of furniture, machines and countless other inanimate subjects. Fig. 7 shows a cube having its three surfaces illuminated about equally with one source of light. Flat lighting might do occasionally for portraiture, when a person has many deep lines in his face and when the picture must subdue these lines. But flat lighting will never do for inanimate subjects, as Fig. 7 demonstrates. So the main light—a soft spotlight—is placed to one side behind the subject. Fig. 8 shows the result of using this light alone. In this case the top of the cube was brighter than the platform and an exposure was made to render the top white in order not to leave any doubt as to the color of the cube. The light was set high enough to get this effect and focused to a small enough area to keep the light from running out of the picture. A secondary lamp used alone, illuminated the cube as shown in Fig. 9, being placed opposite the spot and low enough not to throw a second shadow on the platform. It was dim enough to render the sides darker than the top when both lamps were used together, producing the effect shown in Fig. 10. No other lamps were needed. If you had to photograph a machine with a dark finish instead of the white cube, you would need two secondary lights from low angles. One would be moved over to the left side for texture lighting of the left-hand surface, and the other would be placed at the right-hand side for texture lighting of the darkest surface.

Exactly the same lighting in the same

direction as was applied to the cube, was used on the subject shown in Figs. 11, 12 and 13. Fig. 11 shows the effect of the main light which highlights the hands and the piano keys, and throws shadows. Fig. 12 shows the result of the secondary light placed low on the opposite side, and Fig. 13 shows the photo resulting from the use of both lights. In this case these were photo-floods used with reflectors.

No matter what subjects you select, the principles of good conventional lighting will apply. Figs. 14 and 15 give a look into a living room. To introduce depth we need the main light where it was placed as in the case of the cube—at the far end away from the camera. If this is not done, an uninviting picture such as shown in Fig. 14 results. In this case the light was placed in the foreground and the far end is dark, save for the sunlight on the Venetian blinds. Fig. 15 is lighted properly, with emphasis on the far end of the room.

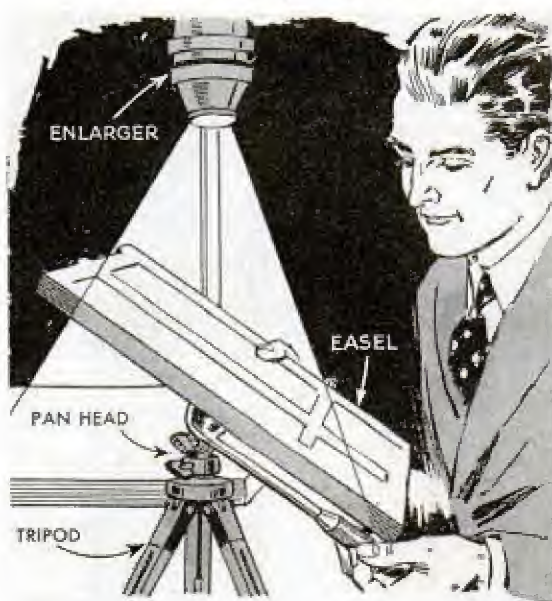
### Wire Solder Ties Lamp Cord

Extension cords on photo lamps can be kept coiled neatly while not in use by wrapping a length of wire solder around each one after it is rolled up. No twists or knots are necessary, and the solder can be used over and over.





## Enlarging Easel on Tripod Head Tilts in Any Direction



Distortion in negatives often can be corrected by tilting the easel when an enlargement is made. One of the best methods of doing this is to secure it to the pan head of a tripod. The head may be left on the tripod, which then must be lowered and placed under the enlarger. Or, the head may be removed and fastened to the enlarger table.

## Container for Storing Camera

If it becomes necessary to store a camera for an indefinite length of time, I recommend the following method: After you have oiled and cleaned the camera, put it in a strong cardboard carton and seal the seams with paper tape. Then dip half of the carton in melted paraffin, let it cool and then dip the other half. In this way, you have a waterproof container that will cushion the camera against knocks and prevent tampering.

—John J. Ryan, Union City, N. J.

## Camera Filters Are Convenient In Cigarette Case Holder



Your camera color filters can be carried conveniently and safely, and the one you need is always easy to locate in this holder, which is made from an old metal or plastic cigarette case. First, fit and glue

a white sheet of paper in the bottom of the case. Arrange the filters on this white paper and mark their location, after which identification references are entered in the spaces they cover. Then a piece of  $\frac{1}{4}$ -in. plywood is cut to fit, after which holes are bored to take the filters in the same position as marked on the paper. Gluing the plywood to the paper completes the job.

## Paper Clips Hold Diffusing Screen On Photoflood Reflector

Four paper clips provide a convenient means of fastening a piece of cheesecloth or other material in front of a photoflood bulb to serve as a diffusing screen. The large ends of the clips are cut off as shown in the inset and the small ends run through the corners of the cloth. The hook formed on each clip by cutting off the large end is slipped over the rim of the reflector.



## Drinking Glass Handy Container For Developing Cut Film

Ordinary 8-oz. drinking glasses come in handy when you wish to develop a few sheets of cut film. Simply fill the glasses with developing solution and insert the film as shown.

—Wm. Swallow, Brooklyn, N. Y.



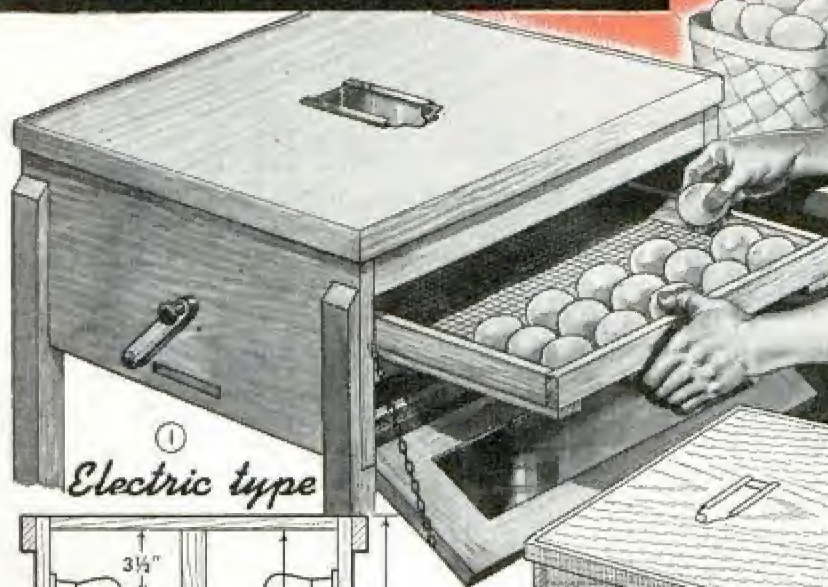




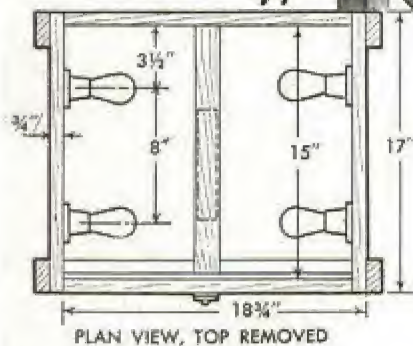
# SHOP NOTES

## INCUBATORS *you can make*

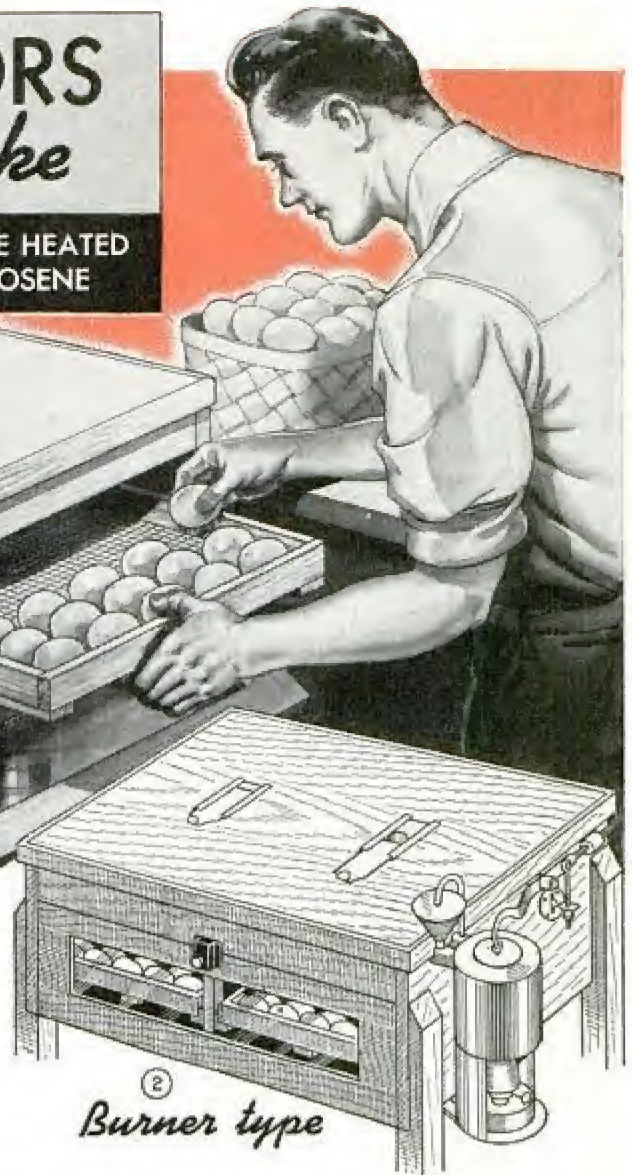
CHOICE OF A 50 OR 200-EGG SIZE HEATED  
EITHER BY ELECTRICITY OR KEROSENE



①  
*Electric type*



PLAN VIEW, TOP REMOVED



②  
*Burner type*

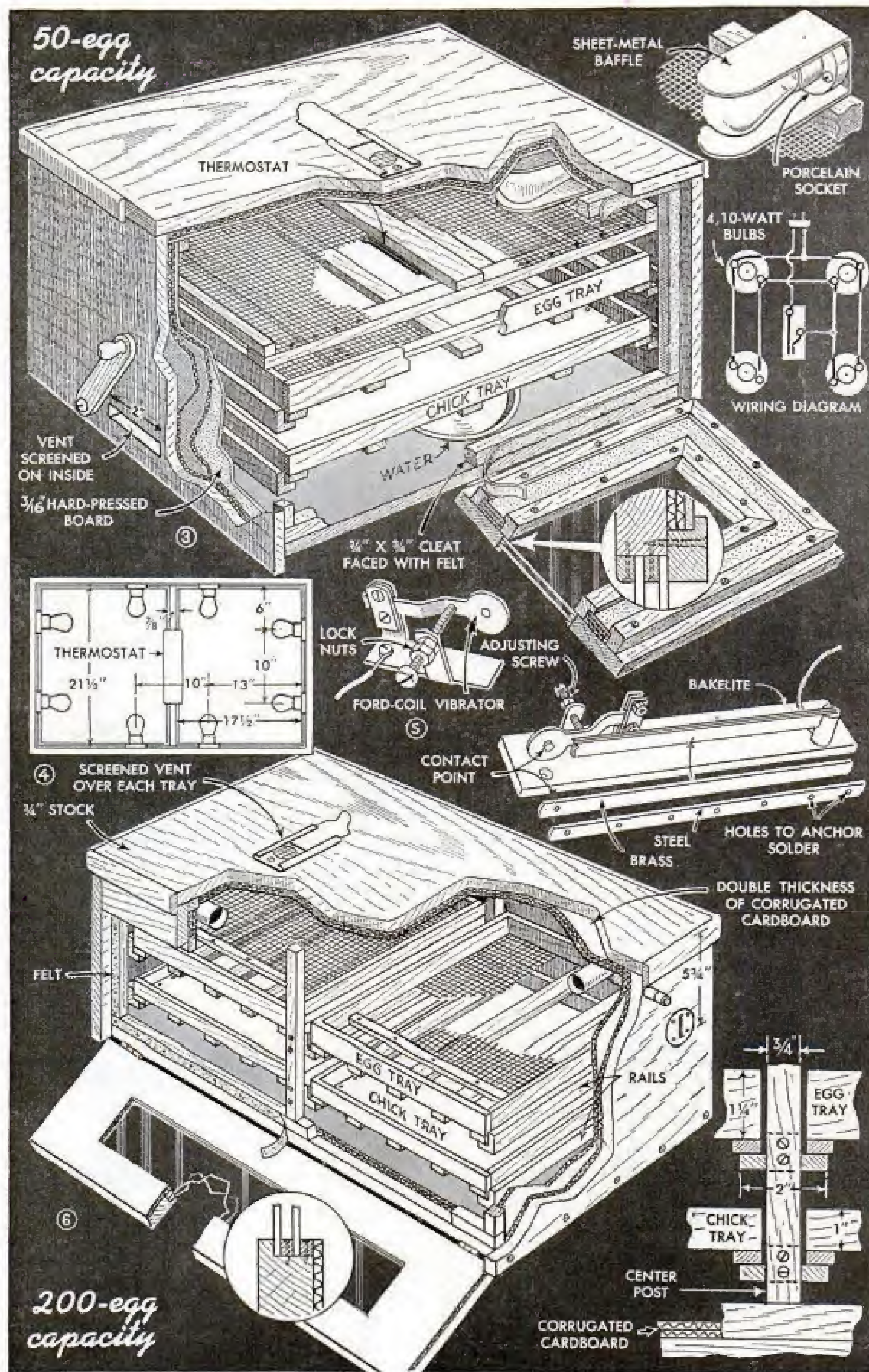
**I**NABILITY to purchase an incubator need be no handicap to hatching and raising your own chickens, because even the most inexperienced craftsman can make either of the types shown. The 50-egg, electric type pictured in Fig. 1, consists merely of an insulated box, in which the heat is supplied by four small electric bulbs, and the temperature regulated automatically by a home-made thermostat of the simplest design. Pull-out trays accom-

modate eggs and the hatched chicks, while a glass-paneled door permits inspection at all times.

The plan view is shown below Fig. 1, as well as the relative locations of lights. The box may be equipped with legs, or simply placed on a bench, box or table. Figs. 3 and 8 show the details of construction and assembly. First, the sides and back are mounted on the bottom, insulated with two layers of corrugated cardboard, and cov-



50-egg capacity



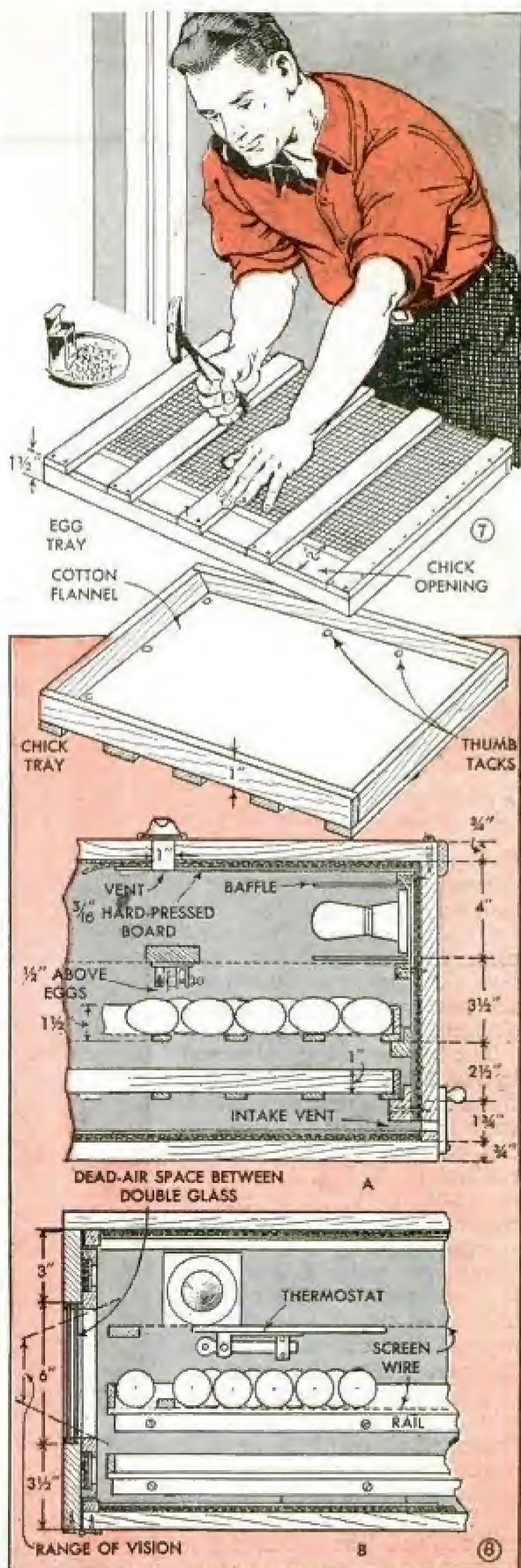


ered with  $\frac{3}{16}$ -in. hard-pressed board. Then, cleats, rails and thermostat are installed as shown, and the top insulated and screwed in place. In Fig. 8, detail A shows the end view and detail B the side view.

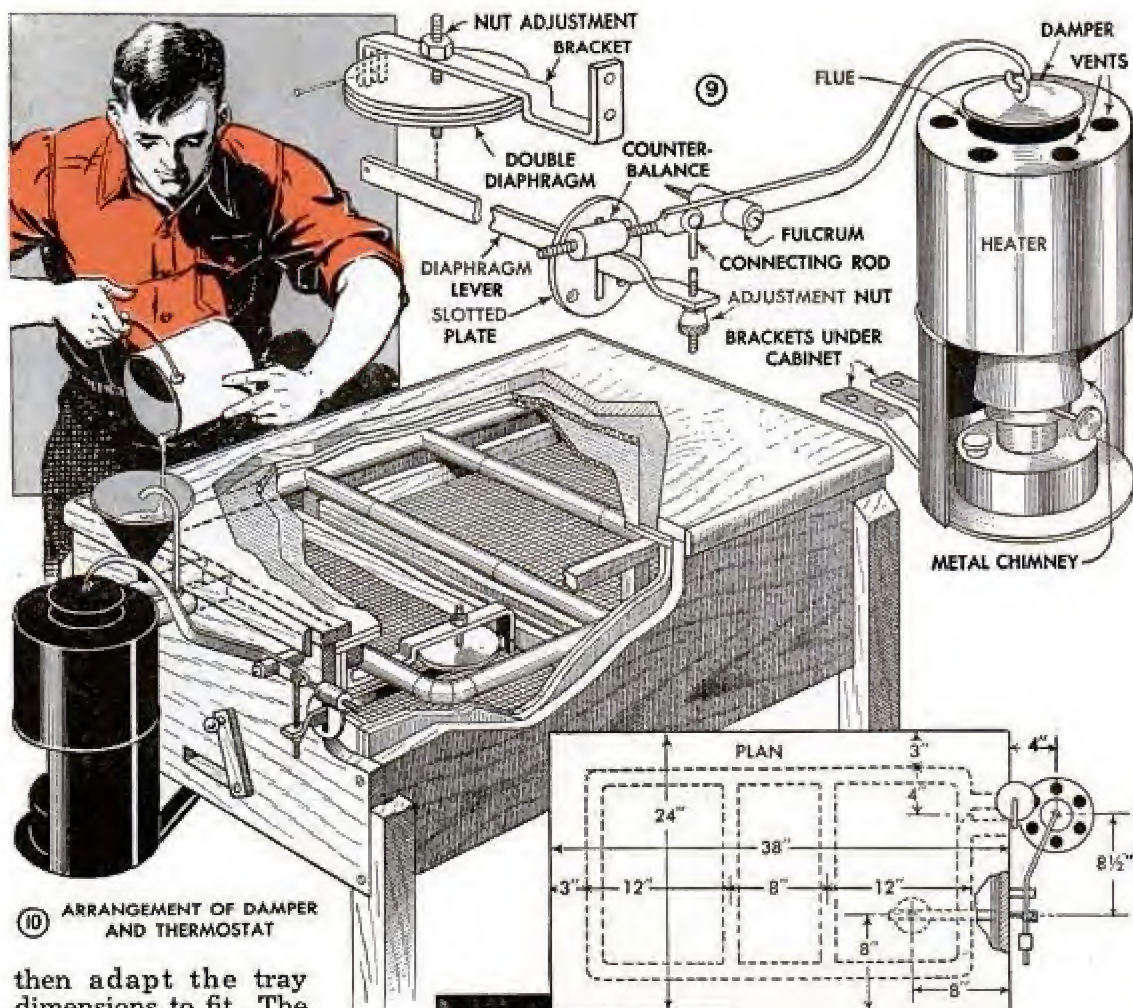
The thermostat, detailed in Fig. 5, breaks the current when the temperature rises above 102 degrees. The only moving part consists of a bar made up by soldering together two different metals having unequal degrees of expansion, such as brass and steel. The brass expands faster than the steel and causes the bar to bend toward the steel side. By fitting contact points, such as auto distributor points, and adjusting them to break at 102 degrees, the thermostat is ready for use. Screw the Bakelite base to the underside of a wood strip, located so that it will clear the top of the eggs in the tray below about  $\frac{1}{2}$  in. A wire screen is placed above this to distribute the heat from the lamps uniformly. Next, install the four lamps, each having a sheet-metal baffle above and below, and complete the wiring as in the detail at the right of Fig. 3.

The egg and chick trays should slide freely on the rails. Exact dimensions are not given as the thickness of the insulation on the walls of the box may vary in individual cases, and the space should be measured between the rails for the trays. Note that the egg tray has a screen-wire bottom, Fig. 7, and an opening at the front end for the chicks to drop through to the chick tray soon after hatching. The opening is covered with a metal strip to support eggs during hatching time. When a sufficient number of eggs have hatched, push the eggs from the strip, and remove it so that chicks will drop through to the nursery tray as they work forward toward the light of the window. Flannel is used on the floor of the chick tray, Fig. 8, and is secured with thumbtacks so that it can be removed for washing. The door also is insulated, and has a double pane window with a dead-air space between the panes.

The larger incubator in Fig. 6 is similar to the 50-egg unit. There are eight bulbs, two trays, and the door, which does not come all the way to the top of the cabinet. Thermostats in the two models are identical. The egg and chick trays, however, are of stronger construction than in the smaller model, having beveled side members and heavier slats. Locations of the bulbs are given in Fig. 4. Inasmuch as several kinds of insulation material are available, and vary in thickness, select the best and







10 ARRANGEMENT OF DAMPER AND THERMOSTAT

then adapt the tray dimensions to fit. The trays should slide freely, so allow plenty of clearance for the rails. The low door is necessitated by the portion of front wall required to support the bulbs.

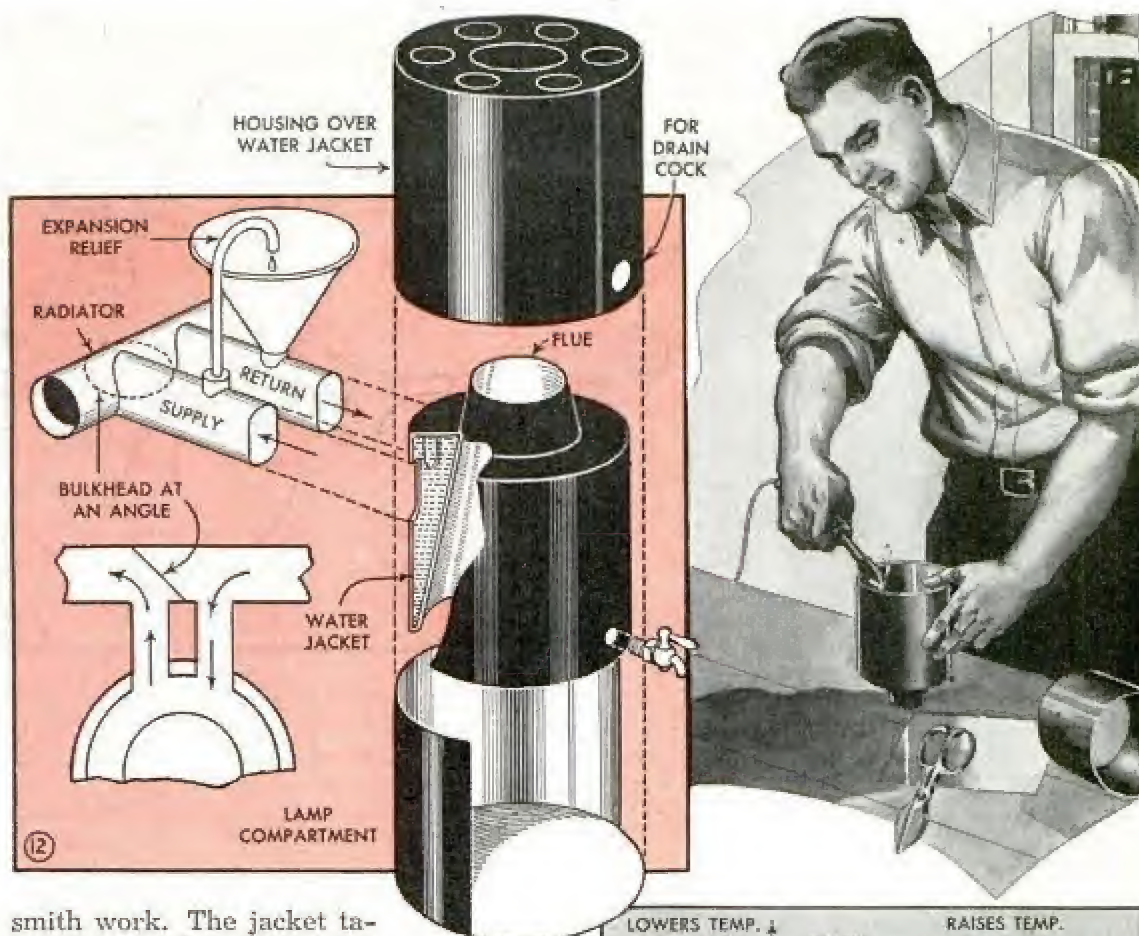
The kerosene type pictured in Fig. 2 is a necessity where there is no electric service. A very satisfactory incubator can be built with the same cabinet as in Fig. 1, using a warm-water radiator and a wafer or diaphragm-type thermostat. Fig. 10 shows the complete unit. A kerosene lamp supported on the outside heats the water in a jacket around the chimney, and a damper, operated by the thermostat, regulates the heat, which is distributed through overhead pipes of tin or galvanized sheet iron. Location and dimensions of the radiator are given in the plan. The side view in Fig. 11 shows details of the heating unit and control. The radiator is well above the tops of the eggs, and no screen is installed

to distribute the heat as in the electric models. Assembly of the heater and thermostatic control is given in Fig. 9. The double diaphragm or expanding wafer is supported  $\frac{3}{4}$  in. above the eggs on a flat-iron bracket, the center bar being threaded for adjusting up through the bracket, which has been tapped, and locked with a nut on top. As the wafer expands with rising temperature, it pushes down the pivoted lever below, which then raises the damper arm on the heater. A nut on the connecting link between the arm and lever permits adjustment, and a counterbalance on the

end of the damper arm equalizes the weight so that operation is sensitive, requiring very little pressure to raise the damper, which lowers by gravity.

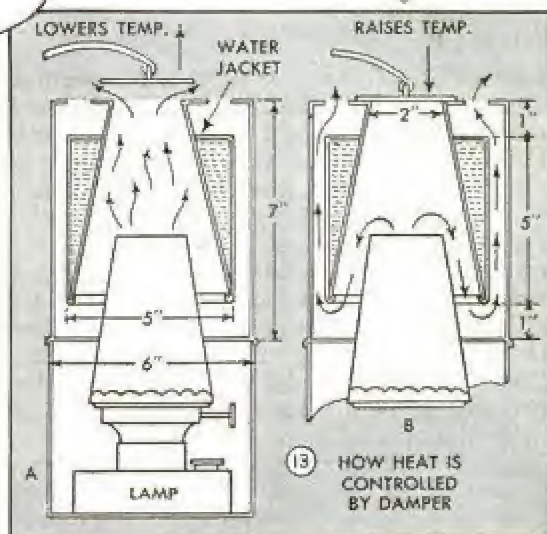
In making the water jacket and radiator, some experience will be necessary in tin-





smith work. The jacket tapers toward the top, forming a flue, Fig. 13, and has a supply and a return pipe soldered in the side at the top. A drain cock also is installed for letting out the water when not in use. A housing, Fig. 12, is placed over the jacket, and a compartment for the lamp is placed below. This should be adapted to the lamp used. Any ordinary kerosene lamp, if not too large and awkward, will be satisfactory. Remove the glass chimney and substitute one of sheet metal, and rivet the seam. Do not solder it. If possible, install a mica window so that you can see the lamp flame from a distance. Otherwise, you will have to feel the pipes when the damper is down. An overflow or expansion tube is installed in the supply line, and a funnel for filling, is installed in the return pipe. A bulkhead set at an angle to aid circulation is soldered into the radiator as shown. Action of the damper is illustrated in Fig. 13. When it is raised above the flue, as at A the heat passes up freely, but when the damper is lowered, as at B the heat must pass down and up the outside of the water jacket, contacting its entire surface.

With the incubator complete, you are now ready to prepare it for the eggs. It is of greatest importance to use the best eggs obtainable. You can test the eggs for fertility, Fig. 14, with one of the homemade



testers shown in Fig. 15. Fertile eggs show a germ as illustrated. Eggs shipped from a distance should stand on their small end for 24 hrs. to regain their normal condition. To prepare the incubator, withdraw the egg tray and cover the bottom, including the metal strip, with several layers of paper. Replace in incubator without the eggs and adjust the thermostat to maintain a temperature of 102 degrees, and leave for 24 hours. If you are using the burner type, regulate the heat control after having filled the radiator and jacket. Use only clean





INCUBATION TIME	
HEN (DOMESTIC)	21 DAYS
PHEASANT	25 "
DUCK (DOMESTIC)	28 "
PEA FOWL	28 "
GUINEA	25 "
GOOSE	30 "
PARTRIDGE	24 "
DUCK (BARBARY)	30 "
TURKEY	28 "
SWAN	40 "

kerosene in the lamp; light it off the machine and let it burn 15 min. Then blow it out and trim the wick. Adjust the wafer in the bracket so that there is about  $\frac{3}{8}$  in. clearance between it and the lever below. Warm up the radiator gradually. When the thermometer reaches 102 degrees the lug on the bottom of the wafer should just touch the lever sufficiently to raise the damper  $\frac{1}{8}$  in. If the damper rises too soon, lower the adjusting nut on the connecting link. Incidentally, in filling the radiator, use soft or rainwater and warm it a little first on a stove.

After warming up the incubator for a period of 24 hrs., fill the tray with eggs. They should fill all the space; a few can be stood on the small end away from the thermostat. Place a thermometer (incubator thermometer only) to one side of the thermostat at the third or fourth row from the door. After seven days, in warm weather, remove the paper from under the eggs; 10 to 14 days in cold weather. Keep the tray crowded, even if necessary to put a block or stick of wood in back. Allow the eggs to absorb heat gradually, but do not change the adjustment of the thermostat. The first week it should be set for 102 degrees, with white eggs, second week 103, fourth week 104, and during hatching 104 to 105. For



dark eggs, run 1 degree higher each week. Hen eggs require 21 days to hatch; but begin counting from the second day.

On the fourth day, and twice each day thereafter up to and including the eighteenth day, (room temperature should be about 65 degrees F.) place the egg tray on top of the incubator, close the door, lay aside

some of the eggs from the center of the tray and roll others back and forth, finally leaving them toward the center. Do the same with the eggs that were laid aside, finally placing them around the edges of the tray. Leave all the eggs out until they feel cool to the cheek, or about 5 to 10 min., the first week, 10 to 15 min. the second, 15 to 20 min. the third. Just before hatching, cover the eggs with a porous woolen cloth wrung out of warm water. This helps the chicks to break the shells. Remove the cloth as soon as hatching starts.

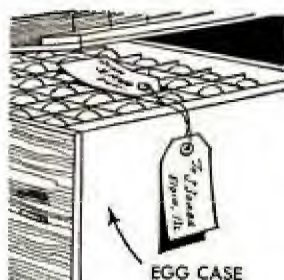
Duck and goose eggs require more moisture than hen eggs, and a tray of wet sand placed on the slats of the chick tray in addition to a water pan below, is recommended. To control moisture at desired temperature keep the top ventilators closed the first seven days, but keep the bottom vents half open. Wider opening of the bottom vents will increase moisture; wider opening at the top decreases it. Incorrect moisture conditions will cause a sticky or bloody hatch and also cause chicks to die in the shell. The ideal place for an incubator is a warm, dry, well-ventilated basement where the temperature is fairly even. Level the incubator. Keep the radiator of the burner type full, adding a small amount of water each day. Watch out for water in



the kerosene; it might collect in the bottom of the lamp and put out the light. After hatching, chicks should be left in the chick trays until they are thoroughly dry and have gained some strength. They should never be subjected to sudden changes of temperature. When removing the chicks from the incubator to a brooder, carry them in a covered basket or a carton lined with soft material.

(How to make brooders in next issue)

## Twin Tags on Egg Shipping Case Assure Prompt Return



Poultrymen and others who ship eggs in individual cases often find that the cases are not returned promptly, usually because of the inconvenience to the customer of preparing a return

shipping tag. To avoid this, one poultryman wired two tags to each case, printing the customer's name and address on one tag and his own name on the other one. With this arrangement, providing the proper address is just a matter of leaving the correct tag hanging outside the box when the lid is nailed in place.

## Comb Guard From Safety Razor Scrapes Labels From Cartons

Instead of dulling the edge of a pocket knife by using it to scrape old shipping labels from cartons, one clerk uses a comb guard from an old safety razor. This is attached to one side of his most-used stamp block where it is always at hand, yet does not interfere with the regular use of the stamp.



## Making Cut-In Paste Substitute

A good substitute for cut-in pastes, which will do an excellent masking job and is washed off easily, can be made by adding a sufficient quantity of diatomaceous earth to liquid soap to make a paste having the same consistency as the commercial variety. If diatomaceous earth is not available, powdered China clay will serve the purpose.—Fred D. Johnson, Toronto, Can.

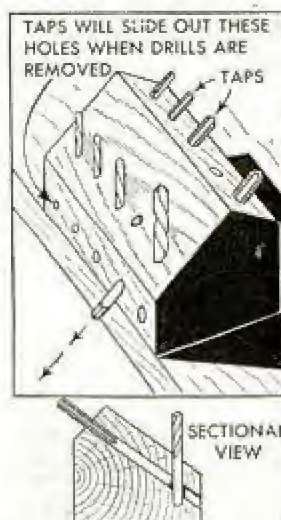
## Two Simple Ideas That Save Time For Artists and Draftsmen



Slotted through the center and pivoted to the underside of a drawing board, a thin strip of wood provides a good holder for thumbtacks. The tacks should project through the slot slightly so that they can be removed easily with the fingers. If you are bothered by ink on the edge of your ruler or triangle, rolled paper towels in a hole in the edge of your drawing board will provide a renewable wiper.

## This Tap Rack Assures That Drill Of Correct Size Will Be Used

If you sometimes have trouble locating the correct size drill to use with a tap because the drill was not returned to the rack, or was placed incorrectly in it, the rack shown will prevent this trouble. As indicated, the tap will slide out of the rack unless the drill is put in place first. Also, this idea is handy when removing a tap as it will slide from the rack when the drill is taken out. The rack is made from a block of wood, which is shaped and drilled as indicated.





## Most-Needed Tools Kept Handy In Simple Rack on Chest



To avoid loss of time on a job, one carpenter provided his tool chest with a rack along the front in which the particular tools needed on that job may be kept conveniently at hand. The rack consists of a length of discarded fabric belting, nailed to the chest as shown, and a strip of molding, which is tacked just far enough below the fabric to hold the tools in place. Since it is easier to slip any tool not needed at the moment into the proper place in the rack than it is to open the chest to put it away, tools are less apt to be mislaid, and can always be found when needed.

## Spring Release for a Trip Rope On Tractor-Towed Implement

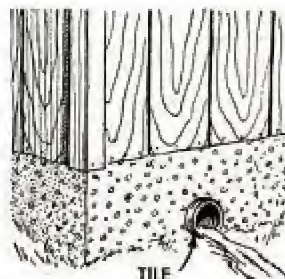
If the safety hitch on a tractor releases, breakage of the implement trip rope, which usually is tied to the tractor seat,



can be prevented by this simple spring trip. The first coil at one end of a light spring is bent up to form a strike for the trip, which is hinged to the other end of the spring as indicated. Any pull strong enough to stretch the spring will let the trip fly back and release the rope.

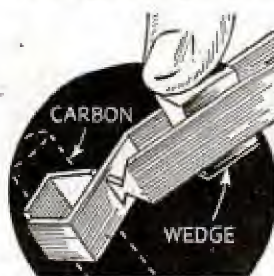
## W. T. M. Concrete Drainage Tile Set in Foundation Prevents Flooding of Building

When a building having a masonry foundation is constructed on sloping ground, it is a good idea to put a common clay tile in the foundation at the ground level on the low side of the building.



This will provide drainage and prevent flooding during heavy rains. A cover of wire mesh will keep out rodents, and a solid cover can be provided to keep out cold drafts during the winter months.

## Wedge Improves Welding Torch

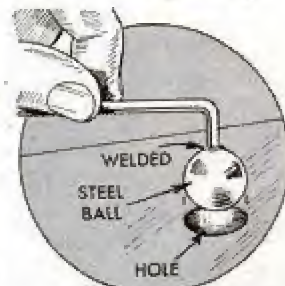


After being in use for some time, the clamps on some types of small contact welding outfits become more or less ineffective, especially in their ability to grip the smaller sizes of

carbons. I found that a wooden wedge inserted between the arms of the torch and tightened with the fingers caused any size of carbon to stay in position firmly without slipping when pressure was applied to the point.—W. C. Wilhite, Carlinville, Ill.

## Ball Substituted for Plug Gage

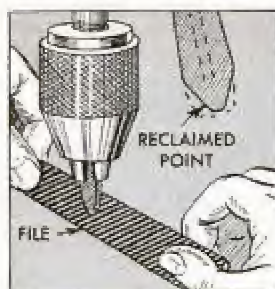
When boring a hole 1 in. in diameter or larger that must be held to size, a plug gage is used, and there is a chance of tipping the gage, making it hard to start. However, by using a ball bearing of the same size as a gage and welding a handle to it as indicated, there is no chance of tipping, thus making the hole easy to size.



—Harold J. Volman, Cicero, Ill.



## Reclaiming Spot-Welder, Points



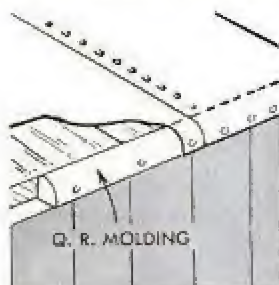
Due to the shortage of copper, every user of a spot welder tries to make the points last as long as possible. I have a timesaving method of reconditioning the points by shaping them in a

drill press. To do this, the point is chucked in the drill press, which is then rotated at approximately 1750 r.p.m. while a file is held at the correct angle against the lower end of the point. The few minutes spent in shaping the point practically doubles its life.

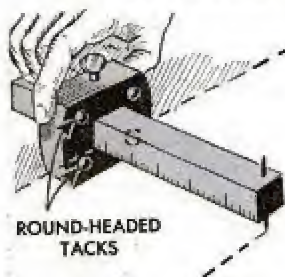
—C. H. Calloway, Houston, Tex.

## Roofing Paper at Eave of Shed Protected by Quarter Round

Because it was necessary at times to turn the cattle into his hog pasture, and finding that they rubbed against the eaves of his individual hog houses and damaged the roofing, one farmer prevented this trouble by rounding the edges of the roof boards where the roofing paper was folded over it. This was done by nailing 1-in. quarter round along the edges and then folding the roofing over it and nailing it in place. This covered the knifelike edge of the boards so that the roofing was not damaged.



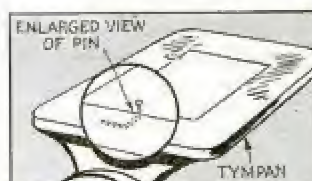
## Tacks Make Marking Gage Slide Easily Along Edge of Work



Jerky movement of a marking gage that causes an irregular score when using it on rough work can be avoided by driving four round-headed tacks into the gage as indicated. The tack

heads serve as glides against the work and permit the gage to be moved along smoothly. When setting the gage it will be necessary to make allowance for the thickness of the tack heads if it is required that the score line be an exact given distance from the edge of the work.

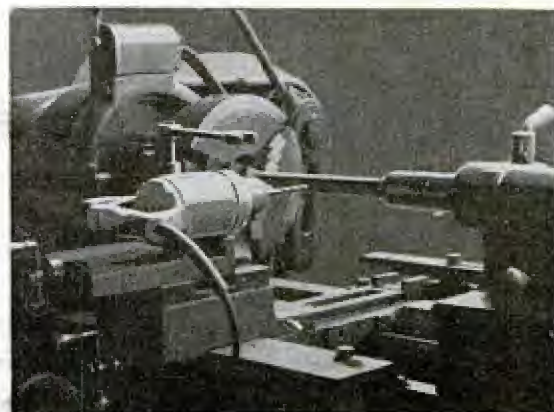
## Printers' Gage Pins Improvised From Regular Straight Pins



Needing several extra gage pins in an emergency, one printer improvised them from common straight pins of the household type. These were shaped as indicated by making two right-angle bends in them so that when they were stuck under the tympan draw sheet the upper portions of the pins would project vertically above the sheet.—Arthur Trauffer, Davenport, Iowa.

## Lathe Setup to Drill Holes Through Round Stock

Drilling accurate holes through round stock is easy with the lathe setup shown. The stock is chucked in the lathe, supporting the outer end with the tailstock, and an electric drill is fitted to the toolpost holder by means of a bracket. The assembly must be located so that the end of the drill is at right angles to the centerline of the lathe through the centers. Holes can be drilled in a straight line either at an angle or straight through the center of the work.



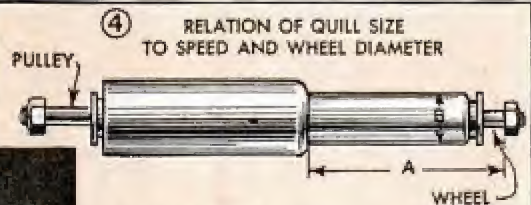
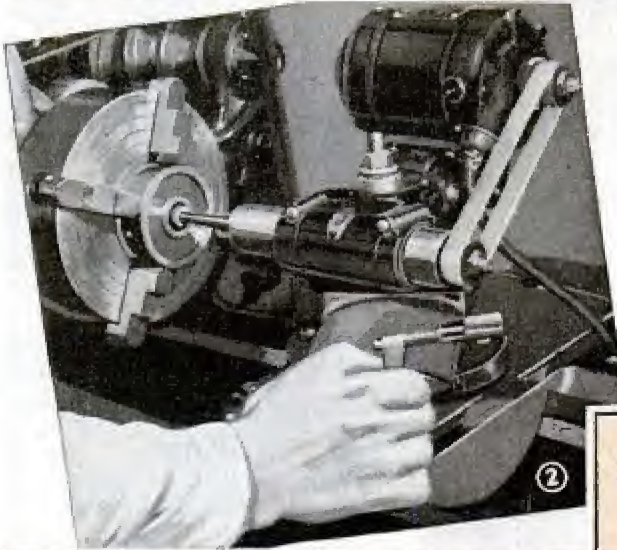
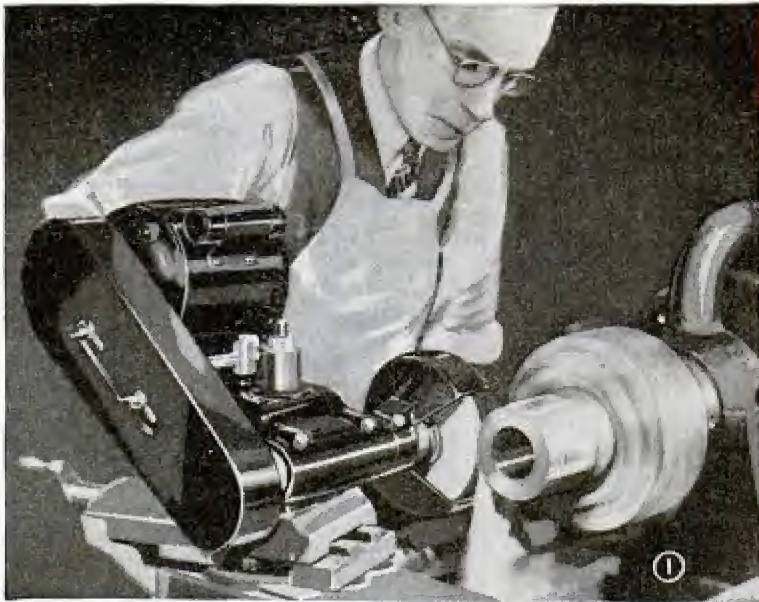


# How to Use

By  
H. J. Chamberland

MANY years ago a clever machinist conceived the idea of mounting a small portable grinder on the tool post of his lathe in order to finish hardened parts that could not be cut by a lathe tool. This was the beginning of portable precision grinders and, owing to their original use, it is not surprising that they are often called tool post or lathe

grinders. However, portable precision grinders are mounted not only on lathes, but also on milling machines, shapers, planers, boring mills and other machine tools. In addition to those specifically intended for such uses, portable grinders are used freehand when precision is not of utmost importance, although these grinders also can be made to do precision work if they are mounted on a rigid base which can be given traverse movement. On the whole, portable precision grinders



A—full depth of hole.

B—diameter of quill or spindle plus 35% gives maximum diameter of grinding wheel to be used at recommended r.p.m.

A	B	R.P.M.
2	$\frac{3}{4}$	32,500
3	$\frac{3}{4}$	25,000
4	$\frac{3}{4}$	25,000
5	$\frac{3}{4}$	15,000
6	$\frac{3}{4}$	15,000
9	1 $\frac{1}{4}$	15,000
13	1 $\frac{1}{4}$	13,500
16	2 $\frac{3}{4}$	8,000
20	2 $\frac{3}{4}$	7,000
24	3	6,000

Note: To compute surface speed, multiply diameter of wheel by 3.1416; then multiply result by r.p.m. of spindle and divide by 12. Final results will be surface speed in feet per minute.

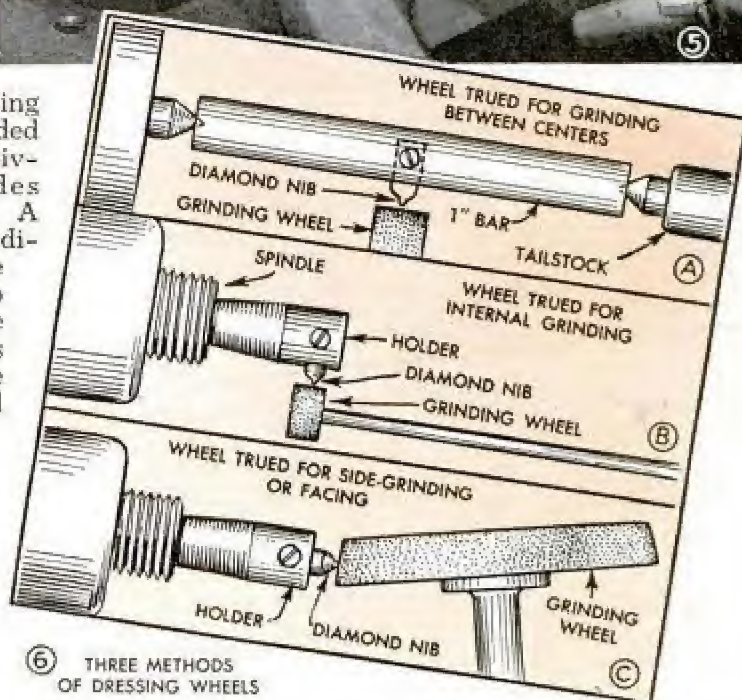
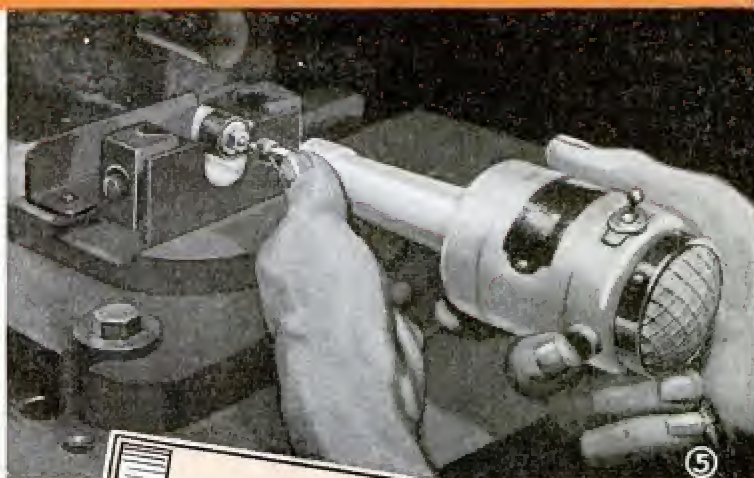


# PORTABLE PRECISION GRINDERS

play such an important role in modern industry that the average machine-tool operator should have a fundamental knowledge of these tools as well as of general grinding practice.

**Construction and selection:** A portable precision grinder consists of a motor-driven quill or spindle having a grinding wheel mounted at one end and a pulley at the other, the latter being belted to the motor. This construction prevents motor vibration from being transmitted to the grinding wheel. Belt slippage is avoided by mounting the motor on a pivot, and a coil spring provides automatic tension to the belt. A number of pulleys of various diameters are interchangeable on both motor and quill to provide various surface speeds for grinding wheels used. A minimum distance between the center of the quill and the center of the mounting post gives the unit rigidity and capacity.

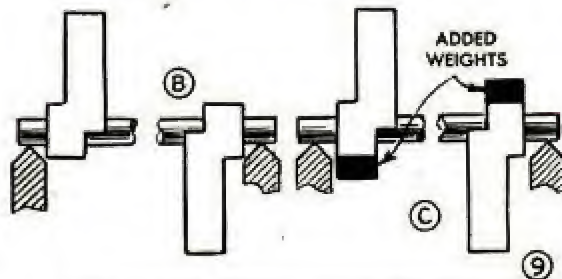
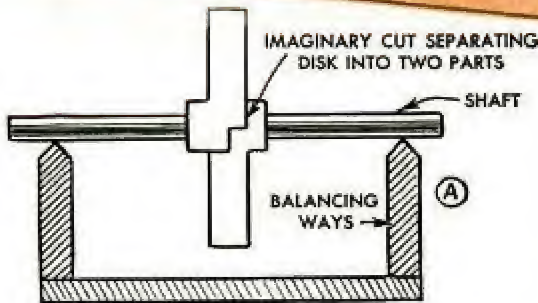
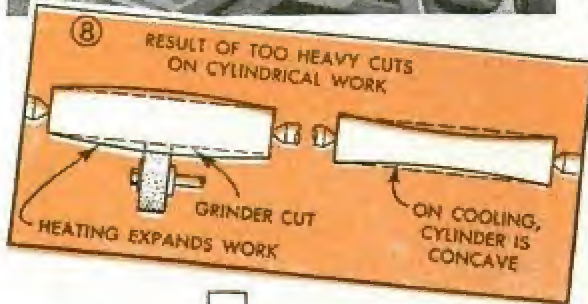
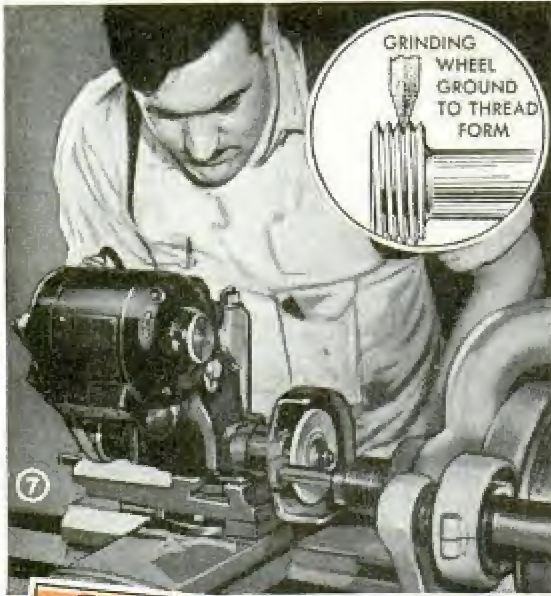
Portable precision grinders are made in numerous sizes and designs so that they will be suitable to all individual requirements. Some heavy models use 6 and 8-in. wheels for grinding externally, while others will grind holes as small as  $\frac{1}{8}$  in. in diameter, and as large as 8 in. in diameter and 24 in. long. Depending on the type of work, some large industrial plants use two and three units in every department while a small shop may get along with the so-called tool-room model shown in Fig. 1, set up for grinding cylindrically in a lathe. On external grinders only one quill or spindle is required, interchangeable pulleys being provided to give the correct speed for the diameter of the wheel used. This speed should be 6,500 surface feet per minute (s.f.p.m.) if a wheel guard is used; otherwise the speed should be reduced to 5,500 s.f.p.m. However, internal grinding work as shown in Fig. 2 requires an assortment of quills to suit all depths and diameters of holes. The shortest and largest diameter quill consistent with the depth and



diameter of a hole should be used. A quill unnecessarily long or slender will invite vibration, which results in a defective hole. Fig. 4 gives safe and practical recommendations on selecting quills of correct size in relation to the speed and diameter of the grinding wheel.

Although all good portable grinders are precision made, they will deliver precision only when clamped or bolted to a rigid mounting that will provide the necessary traverse movement. For example, the portable grinder shown in Fig. 3 is as efficiently constructed as the one shown in Fig. 1, but the latter is being used freehand for roughing or snagging. A smaller but somewhat similar unit is shown in Fig. 5. In this case a die is being retouched directly in a punch press. By handling the grinder carefully one can do accurate work, but





greatest accuracy is obtained by mounting such a grinder as previously mentioned.

**Mounting grinder on lathe:** Before mounting a portable precision grinder on a lathe or any other machine, the voltage marked on the name plate should be checked carefully to see that it corresponds with that of the power supply line. A 110-volt motor will be damaged severely and perhaps ruined completely if used on a 220-volt supply line, and a 220-volt motor will deliver only a fraction of its power output if connected to a 110-volt circuit. When setting up the grinder, remove the mounting post from the grinder and slip the bolt of the mounting post into the T-slot of the lathe compound, after which the T-bolt is tightened. Then slip the grinder onto the mounting post, position it for correct height and lock by tightening the lock screws on the side of the grinder. Next, insert the quill selected and lock it

in place by tightening both lock nuts on the grinder frame. Finally, and this is important, refer to the chart on all name plates of variable speed grinders to determine the correct pulley combination that will provide a safe and practical surface speed for the grinding wheel. Never start the grinder until you have checked and rechecked this. Dependable wheel selections for cylindrical, internal and surface grinding are given in Fig. 10. For precision grinding, a wheel must be dressed properly so that its face is absolutely parallel to the surface being ground. Fig. 6 shows three methods that have been found accurate for dressing grinding wheels. For truing a wheel that is to grind work held between centers, a diamond nib is held in the center of a 1-in. bar, which is held between lathe centers as shown in detail A. The bar is held stationary while the grinding wheel rotates and is slowly moved back and forth. Detail B shows a diamond nib in a tapered holder that fits the headstock spindle of a lathe. This set-up is especially handy for truing small internal grinding wheels. The same holder, with the diamond nib inserted at the end, as shown in detail C is used to face a wheel at an angle.

**GRINDING-WHEEL RECOMMENDATIONS FOR PORTABLE PRECISION GRINDERS**

Cylindrical grinding		Internal grinding		Surface grinding	
High-speed steel	- - 3846-K5BE	High-speed steel	- - 3846-K5BE	High-speed steel	- - 3860-G-8BE
Hardened steel	- - 3846-L5BE	Hardened steel	- - 3846-L5BE	Hardened steel	- - 3846-H-8BE
Soft steel	- - - 3846-N5BE	Soft steel	- - - 3846-L5BE	Soft steel	- - - 3846-J-8BE
Cast iron	- - - 3736-K5	Cast iron	- - - 3746-I5	Cast iron and	
Brass	- - - 3736-L5	Brass	- - - 3736-K5	soft brass or bronze	3746-17

Note: For hand grinding with mounted wheels use two to three grades harder than above. Every grinding-wheel manufacturer has his individual wheel markings; results with different makes are not always identical.

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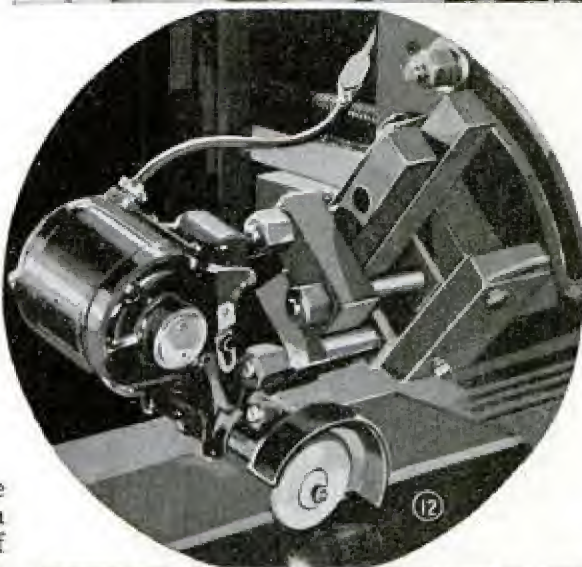
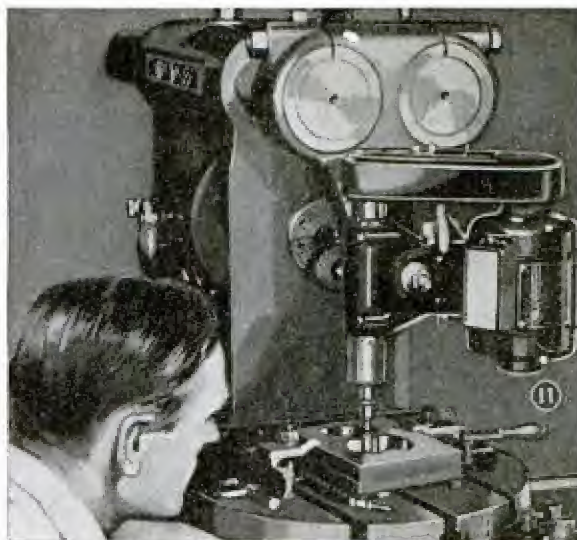


Threads can be ground as easily as they can be cut in a lathe, as shown in Fig. 7. The object of thread grinding is to correct lathe threading errors in lead or pitch and produce a finer finish. Many screw threads that have been made useless by defective heat treatment, can be saved from the scrap pile by grinding them in a lathe. The thread form is reproduced on the grinding wheel with a special dressing fixture.

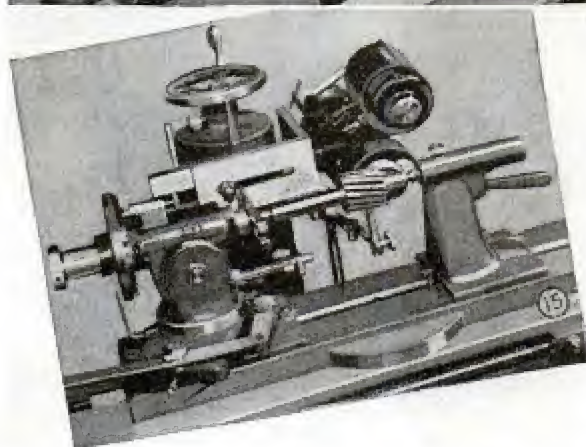
As most portable grinder operations are performed dry, although a coolant is used occasionally, one must exercise care in feeding the wheel to the work. These grinders are not intended to remove a considerable amount of stock and therefore the last .001 in. of metal should be removed with no less than five passes of the grinding wheel. Heavy cuts will cause the work to heat and expand so that after it has been ground and has returned to normal temperature, the work will be slightly concave. This trouble is shown exaggerated in Fig. 8.

**Static and dynamic balance:** A grinding wheel of substantial diameter and width will not do precision work if it is not perfectly balanced to make it vibration-free. Any part of a grinder designed to rotate must be balanced statically (balanced while at rest), and dynamically (balanced while rotating). To test for example a disk for static balance, insert an arbor through its bore, (if not already mounted on an axle), using a medium press fit, and then place the assembly on balancing ways as shown in detail A of Fig. 9. The contact points of the balancing ways are shaped like an inverted V, are exactly the same height, and have knifelike edges to minimize friction. If the part being tested remains stationary on the ways without rolling, it is in static balance. If not thus balanced, weight is added to the light side or it is removed from the heavy side. If a wheel or disk mounted on an arbor is cut in half as shown in detail A of Fig. 9, and both halves are separated as in detail B, without having their relative position altered toward either side, the assembly will still be in static balance when placed on the balancing ways, but it will not be in dynamic balance since neither end of the arbor is balanced separately. Under such a condition centrifugal force of the rotating part tends to produce an up-and-down movement resulting in considerable vibration. The only remedy is to balance each half of the rotating part separately by adding sufficient weight to the light ends as indicated in detail C of Fig. 9.

**Mounting grinder on other machine**







**tools:** If a portable precision grinder is mounted on a planer or shaper, the feed of the table or ram can be determined by the cut-and-try method. However, the feed for finishing should be about one half that for roughing. In Fig. 12, the grinder is doing a surfacing job, clamped directly to the clapper box of a planer. When used on a shaper, it is customary to fit the unit to an angle plate and mount the assembly on the clapper box. Grinding grit should be kept away from the ways of the ram.

For use in a milling machine, the grinder is mounted on the outer arbor support. If such a set-up is attempted regularly, a special quill, made to provide ample lubrication in this position, should be used. The only accessories required are a special T-bolt and plate. Fig. 11 shows a lamination die being contour-ground; the die is

strapped on a rotary table which in turn is bolted to the machine table. A wheel of required diameter and width, dressed parallel to the work surface, permits the operator to manipulate the hand wheels of rotary and regular tables to produce the desired contour.

In Fig. 13 a strainer core, 43 in. in diameter, is being ground externally to

### Remember—

Stand to one side of the wheel when starting.

Never hold wiping cloth or waste near a rotating spindle or wheel.

Dressing the wheel frequently will pay in results.

When grinding a deep hole, use a light feed to avoid "bellying."

Never allow the wheel to project entirely from either end of the work when grinding externally or internally.

The general rule for work speed and traverse feed is that for each revolution of the work, the work should advance two-thirds the width of the wheel.

Too hard a wheel for a particular job will cause chatter and glaze, and will soon burn the surface being ground. Too soft a wheel will break down or wear quickly and produce an uneven surface.

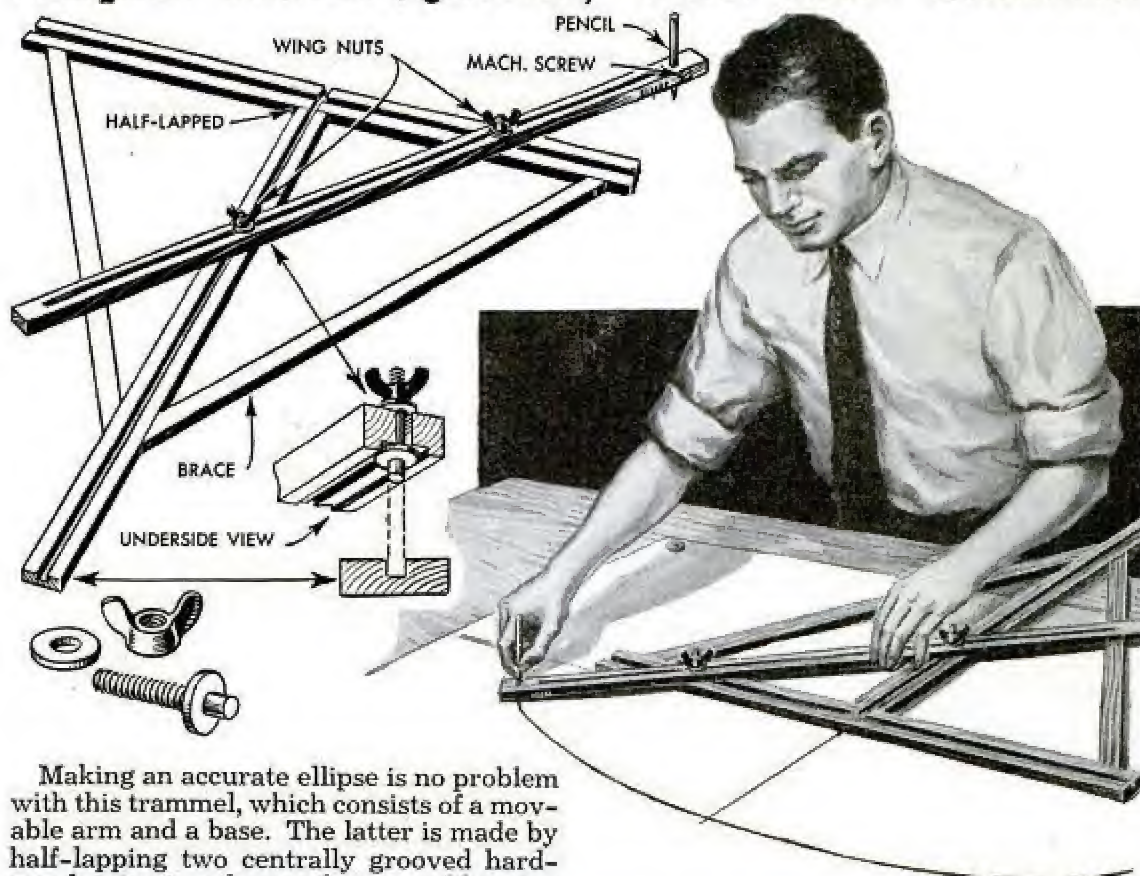
close tolerance with an 8-in. grinding wheel. Incidentally, this operation is angular and the operator is positioned at an elevation of 12 ft. to control the feed vertically. Fig. 14 shows how a small grinder was used to sharpen a formed milling cutter in a bench lathe. Portable precision grinders have also been mounted on drill presses, broaching machines, and have been used as the grinding members of shop-made contouring machines. In Fig. 15 a tool-room portable precision grinder has transformed a regular surface grinder into a universal grinder, resulting in a considerable saving.

### Wear in Worm Drive of Machine Compensated for by Spring

When it is necessary to use an old lathe or other machine having a carriage operated by a worm or lead screw, and the threads are worn so that there is considerable back lash, try using a strong spring to hold the carriage firmly against the threads and thus prevent the back lash. One end of the spring can be fastened to the tailstock or machine bed and the other end to the carriage. The farther the carriage moves from the stationary end of the spring, the tighter it is held against the threads of the worm or lead screw.



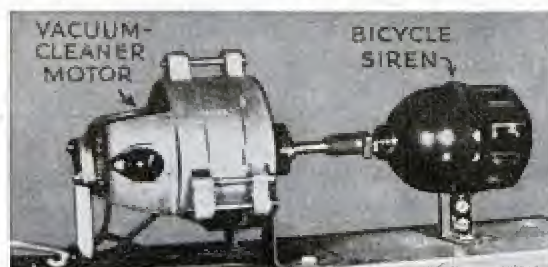
# Ellipses Struck Quickly With This Trammel



Making an accurate ellipse is no problem with this trammel, which consists of a movable arm and a base. The latter is made by half-lapping two centrally grooved hardwood strips together as shown, and bracing them for rigidity. The arm, also of hardwood, is slotted centrally for two adjustable pins, which are a sliding fit in the slot and the grooves. A hole is drilled at one end of the arm for a lead pencil, which is held in place by a small machine screw. Small headless bolts with a washer sweat-soldered near one end of each will do for the pins. Notice that the slot on the underside of the arm is recessed to take the washers. In use, first the major and minor axes of the ellipse are laid out. Then, the base is placed over them so that the groove along the top is centered over the major axis, and the other groove is centered over the minor axis. To adjust the trammel arm, place it on the base parallel with the major axis, the pencil point being exactly at one

end of the latter. Then, set the pin farthest from the pencil at the intersection of the grooves and lock it by tightening the wing nut. To set the other pin, place the arm over the longer part of the base with the pencil point at the upper end of the shorter, or minor, axis and locate the pin at the intersection of the grooves. To strike an ellipse, start with the pencil point at the upper end of the minor axis and move the pencil to the right or left, keeping the pins in their respective grooves. This produces one quarter of the ellipse. Repeat the procedure by swinging the pencil in the opposite direction to complete half of the ellipse. After reversing the position of the trammel base the other half of the ellipse is drawn in the same way.

## Bicycle Siren Is Used for Practice Air Raids Inside Large Buildings



Driven by an old vacuum-cleaner motor, a bicycle siren was used by one firm as a warning for practice air raids. The siren was loud enough to be heard in four connecting buildings. The motor and siren are mounted on a wooden base as indicated. After aligning the motor and siren shafts, a piece of rubber hose provides a good flexible coupling.—H. Miller, Buffalo, N. Y.



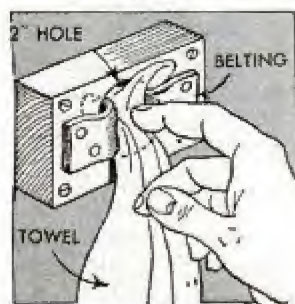
## Shoppers Attracted to Window By Simple Electric Device



Placed in a prominent position in a show window, this simple electrical device will attract the attention of shoppers by electric arcs that travel rapidly upward inside a glass tube and disappear near the top. The device works on the principle that an electric arc drawn in air between two vertical wires will be drawn upward by the rising of heated air. The arc starts at the bottom of the tube and travels to the top where the increasing arc length causes it to snap out, after which another arc is immediately established at the base and the cycle repeated. As shown in the detail, the device consists of a glass tube mounted on a plastic base with two bare wires suspended inside it, the spacing of the wires tapering toward the bottom. The wires are connected to a Neon transformer of 7,000 to 15,000 volts, a.c. The device should be located in the window so that only the tube and base are visible, and also, it should be located so that there is unrestricted air circulation up the tube.

—John Morton, Dixie, W. Va.

## Safety Rack for Shop Towel



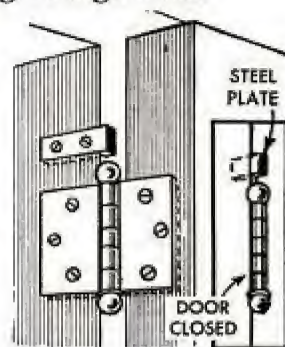
Instead of hanging a shop towel on a nail from which it may be jerked and torn, use a rack or holder like the one shown which will permit the towel to be jerked free without being

damaged. The rack consists of a wooden block having a large hole drilled in the center and two short pieces of belting tacked to it so that the free ends project to the center of the hole. Pushing one corner of a towel into the hole depresses the belt strips, which hold it in place. A slight jerk releases the towel.

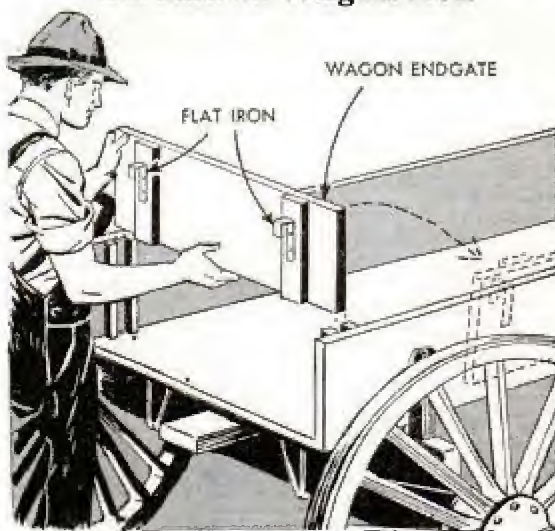
## Entrance to Building Avoided By Locking Hinge Pins

In a tool crib of a defense plant where precision instruments were stored, the possibility of anyone entering the crib by removing the hinge pins from the locked door was prevented by locking the pins.

This was done by setting thick steel plates into the door jamb as indicated. The plates were set into the wood flush with the surface of the jamb to avoid interference with operation of the door. As the screws holding the plates were covered by the door when it was closed, there was no way that they could be removed.—Kenneth Murray, Colon, Mich.



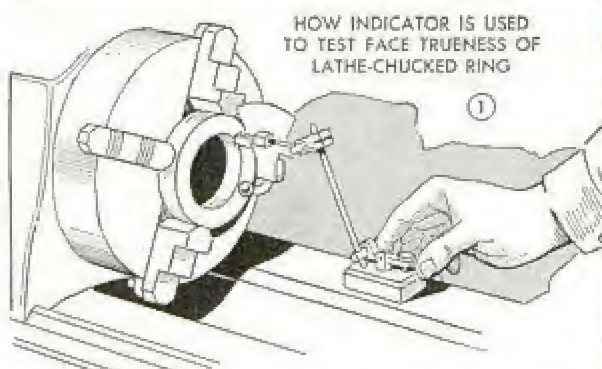
## Hooks on Wagon Endgate Hold It On Side of Wagon Box



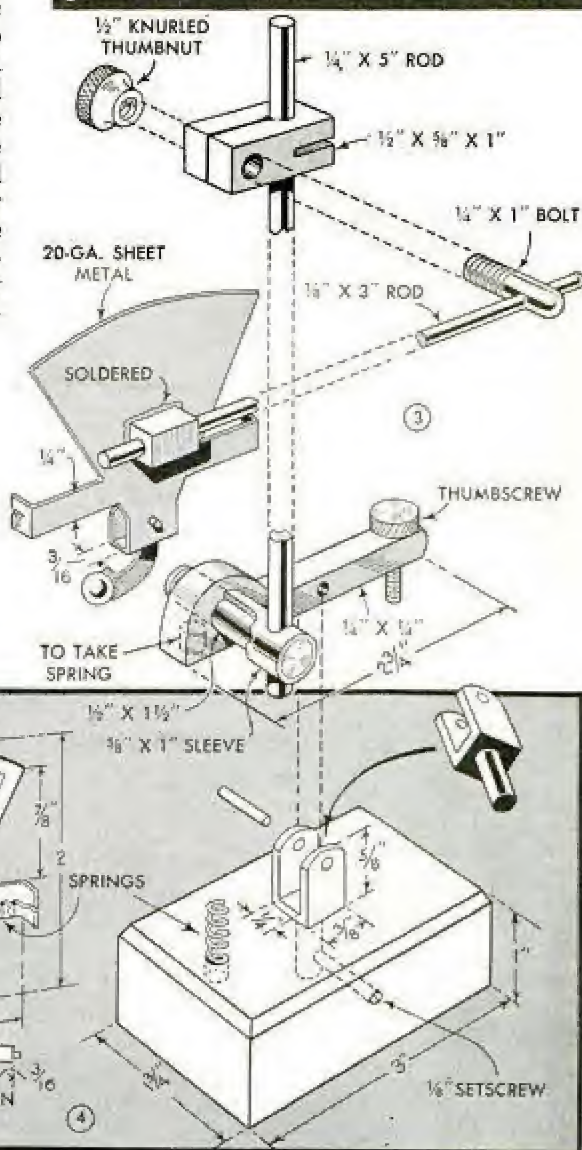
Rather than toss a wagon endgate onto the ground where it might be forgotten or run over and broken when it is removed for loading or unloading, one farmer attached metal hooks to the endgate as indicated. In this way, it could be hung on the side of the wagon box whenever it was not in use.



# Universal TEST INDICATOR



**E**SPECIALLY useful at a metal-turning lathe for centering work in a chuck, checking shafts for wobble, and for setting the tailstock accurately for taper turning, this sensitive test indicator also is handy for making internal tests where a dial-type indicator cannot be used. In using it to make either of the tests shown in Figs. 1 and 2, the indicator is held on the lathe bed and adjusted to bring the knob end of the pointer in contact with the work. Then the lathe is started and the pointer is watched on the scale. As the amount the work may be off center is greatly exaggerated by the movement of the pointer, it is an easy matter to note the slightest eccentricity. Only when the pointer remains practically motionless as the work rotates, will the latter be centered or true, as the case may be. The pull-apart view in Figs. 3 and 4 shows how the various parts go together. A small spring fitted in the base under the pivoted arm gives a positive vernier adjustment to the thumbscrew in bringing the pointer against the work, while two light springs attached to the pointer hold it exactly at 90 degrees on the scale. The latter is part of a celluloid protractor which is cemented to the face of the plate in the position shown. The bottom of the base block should be machined perfectly flat, so that it will set firmly wherever it is placed. Finish all parts nicely to give the tool a good appearance, and make them fit together snugly so that tests will be as accurate as possible. — Russell Rosendahl, Muskegon, Mich.





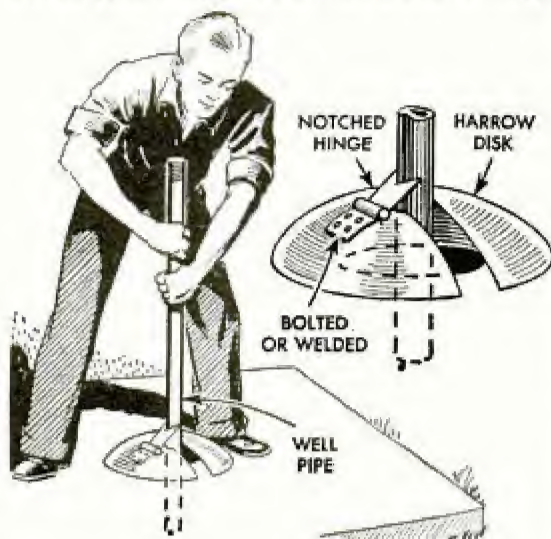
## Bending Offset in Tamping Rod Protects Worker's Knuckles



Noticing that workmen often suffered injured knuckles by having a tamping rod strike against the pole they were setting, the foreman of a telephone line crew had the tamping rods bent with an offset as shown. This permitted the rod to be used close to the pole and yet keep the hands at a safe distance from it.

## Clamp to Hold Suspended Pipe Made From Harrow Disk

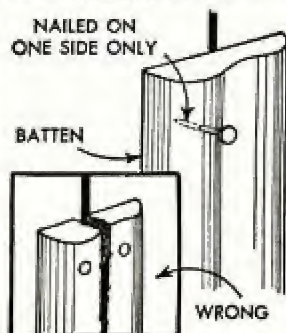
A handy clamp for holding a pipe while it is being lifted from a shallow well can be made from a discarded harrow disk and an old gate hinge. First, cut a slot through



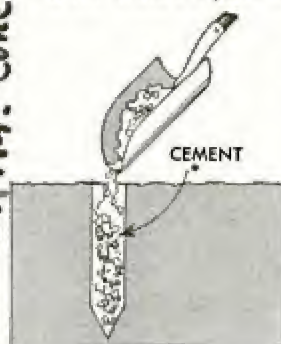
one side of the disk from the edge to the center and then weld or bolt the hinge to one side as indicated. The loose half of the hinge must be notched so that it will rest against the pipe to grip it and prevent it from slipping.

## Barn Battens Nailed on One Side Won't Split if Building Settles

When battens are used to cover cracks between siding boards nailed vertically to a building, it is best to nail them on one side of the crack only. If the battens are nailed on both sides of the crack, any settling of the building or even expansion and contraction of the boards may cause the battens to split, which, of course, defeats their purpose.



## Concrete Is Lasting Substitute For Surveyor's Wood Stakes

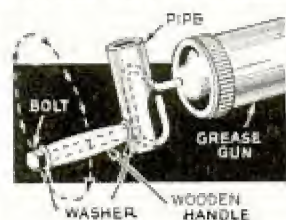


Surveyors often use wooden stakes for corner markers which soon rot off and sometimes make another survey necessary. To avoid this, I always drive the stakes deeply into the ground, then pull them and fill the resulting holes

with concrete, resetting the nail markers exactly in the center of the wet concrete. I have done this for a number of years and find that the concrete provides a lasting marker.—F. W. Wood, Long Beach, Calif

## Crank on Grease Gun Saves Time

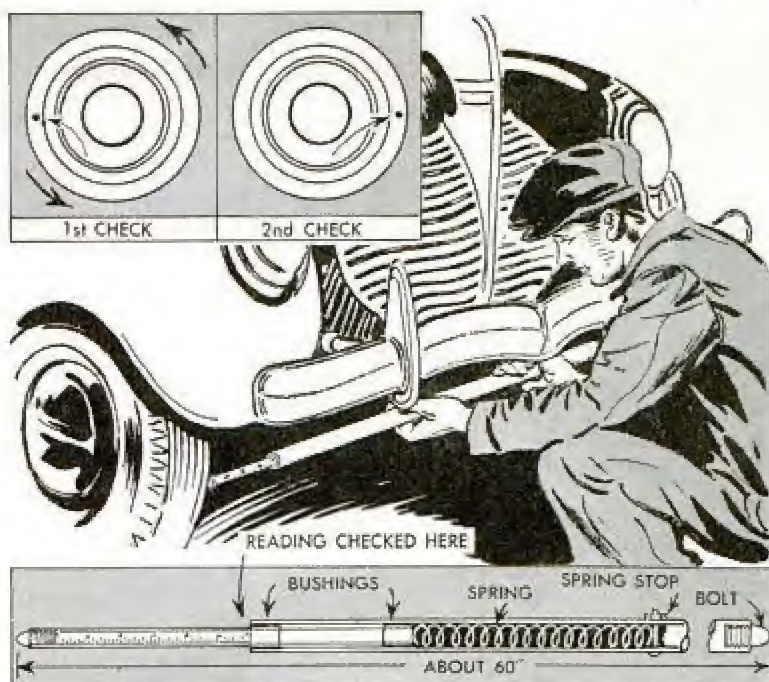
Anyone who has considerable use for a grease gun of the screw type will find that a crank fitted to the plunger rod saves time, especially on fittings that require the application of large amounts of grease. The crank is made by slitting one side of a piece of pipe to fit over the looped end of the plunger rod, and then fitting a wooden handle to the pipe.





# Inexpensive Gage to Check Toe-In of Car Wheels

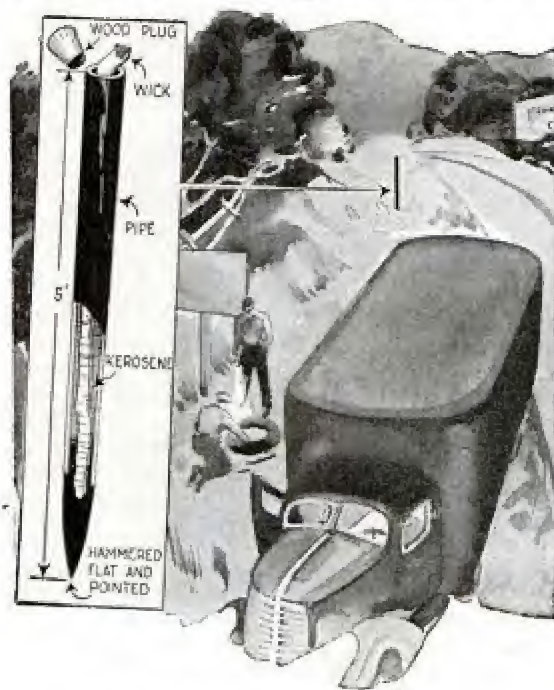
An accurate gage for checking the front wheels of a car can be made from a compression-type coil spring and two lengths of tubing, one piece being of a size to telescope inside the other. The lengths of the spring and tubing pieces should be such that, when assembled, the overall extended length of the gage will be a few inches greater than the distance between the inner surfaces of the front-wheel tires. Notice that short bushings are pressed tightly into one end of the large tube, and over one end of the small tube, the latter bushing being a sliding fit inside the large tube. This arrangement prevents the spring from pushing out the small tube. Bolts cut off and rounded, and then threaded into the tubing ends provide good ends. To calibrate the gage, start with it fully extended and mark off the smaller tube in divisions of  $\frac{1}{8}$  in., beginning at the point where it enters the larger tube. To check the toe-in, place the gage between the tires at the front as indi-



cated, and take the reading at the point where the small tube enters the larger one. Then, leaving the gage in position between the wheels, push the car forward to rotate the wheels one half turn and take the reading again, the difference between the two readings being the amount of toe-in.

—Albert Kebbel, Collinsville, Ill.

# Trucker's Long Flares of Pipe Easily Seen by Motorists



Finding that he sometimes had to walk from several hundred to a thousand or more feet to place his warning flares so that motorists could see them in time, if he had to make an emergency night stop at the base of a low hill, or on a winding road, one truck driver now uses long flares of the type shown. As these project several feet above the ground, they can be placed near the truck and can be seen above low irregularities in the road surface, and are not hidden from view of an oncoming motorist by weeds or bushes along a curve in the road. The flares are merely lengths of pipe, which are pointed at one end for driving into the ground, and filled with kerosene or other fuel. The canvas wick should extend the full length of the pipe. The open end is plugged when the flare is not in use.

¶To find a crack in a cylinder block of a motor, rub the suspected part with machine oil and dry it. Then rub the oiled surface of the metal with powdered chalk, and any cracks will immediately become visible.

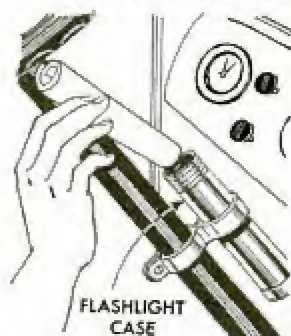


## Stuck Auto Horn Silenced Quickly By Disconnecting Relay



If your car horn sticks and doesn't stop sounding even when the button is released, lift the hood and, with a dime, unscrew the proper terminal on the horn relay. Horn wires then can be removed quickly to silence it until the trouble has been located.

## Old Flashlight Handy Container For Trucker's Papers



Papers that must be presented for frequent inspection are rolled and kept in an old flashlight case by one trucker. The case is held conveniently in the regular flashlight bracket on the steering column.

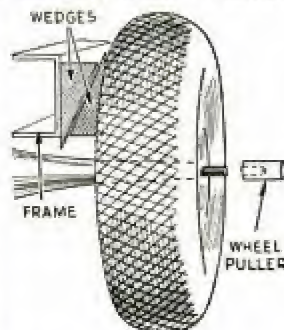
## Taper of Cylinder Bore Measured With a Piston Ring

Here is a simple way to measure the taper in an engine cylinder: First, insert an inverted piston into the cylinder and then a ring, pressing the ring down against the piston, which will hold it at right angles to the axis of the cylinder. Move the assembly to the point of tightest fit, which normally will be near the bottom of the cylinder, and, with a feeler gage, measure the gap between the ring ends. Then move the

assembly to a point in the cylinder where the ring gap is the greatest, usually just under the ring ridge at the top of the bore, and again measure the ring gap. Subtracting the greater measurement from the lesser one and dividing by 3.1416 will give the taper of the cylinder. For all practical purposes, it is sufficient to divide by 3 instead of 3.1416.—C. E. Packer, Chicago.

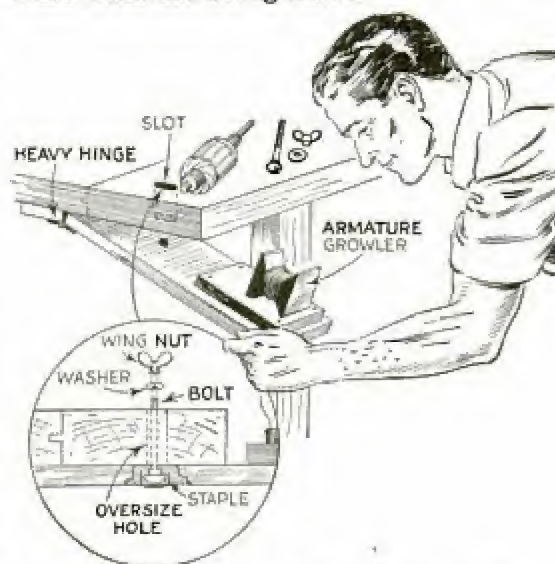
## Wedges Aid in Pulling Car Wheel

When removing a rear wheel with a knock-out type of puller and the hub sticks tightly to the axle, try the following method: Apply the puller in the regular way and jack up the other wheel. Then place a couple of wooden wedges between the wheel and the car frame as indicated. This usually will enable you to remove a wheel without excessive pounding on the puller, which may damage the differential gears.



## Armature Growler on Hinges Swings Under Bench

One garage owner fastened his armature growler to a hinged board that could be swung down under the bench out of the way when not in use, thus keeping the bench clear of bulky apparatus that was required only occasionally. A short bolt mounted vertically in the board just behind the growler comes up through a slot near the edge of the bench. A wing nut and washer on the bolt holds the board in place while tests are being made.





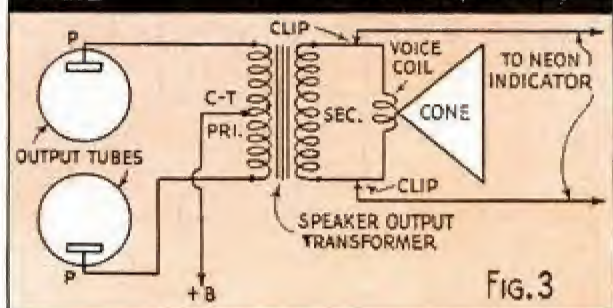
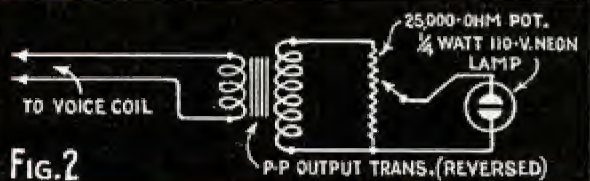
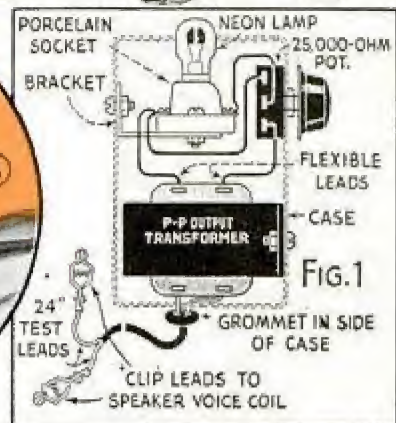
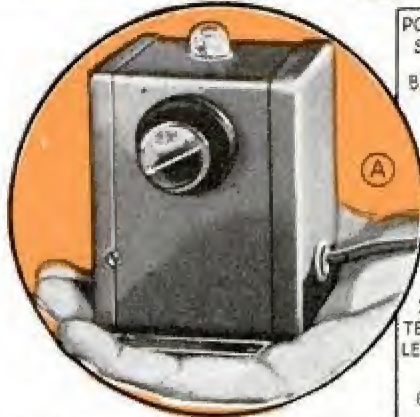


# Radio

## Visual Output Indicator

**M**OST broadcast receivers gradually lose their ability to bring in stations "right on the nose"; in other words they lose some of their original keen selectivity and sensitivity, and should be lined up. Unless very badly out of line this is not a serious matter, and the average radio student or experimenter can check the necessary adjustments with a simple neon output indicator that can be assembled from a few odds and ends that he usually has on hand.

The unit shown in photo A is housed in a discarded transformer case about 4¼ in. high, 2¾ in. deep and about 3 in. wide. With the sides off, this case provides room for mounting an output transformer, a small candelabra-type porcelain socket and a 25,000-ohm potentiometer as illustrated in Fig. 1. A small metal strip furnishes the necessary supporting bracket for the socket. The push-pull output transformer can be any standard open-mounting type salvaged from an old broadcast receiver, as the specifications are not critical. Disregard center-tap leads and make the circuit connections as shown in Fig. 2, with the primary connected to the test leads. These clip to the voice coil of the speaker in the receiver, as indicated in Fig. 3. This transformer steps up the signal voltage across the voice-coil windings, and the potentiometer is adjusted until the neon bulb will flash only when the output voltage is at its peak value. If a signal generator is not available the receiver can be lined up with broadcast station signals; beginning with the first R.F. stage and continuing straight through, adjust the trimmers in each stage.





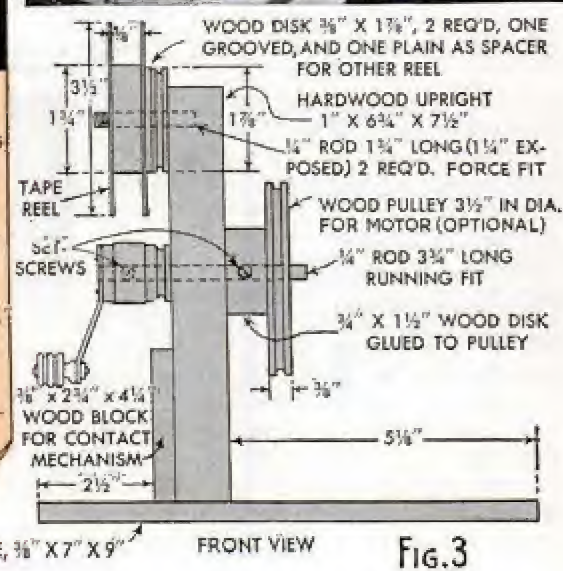
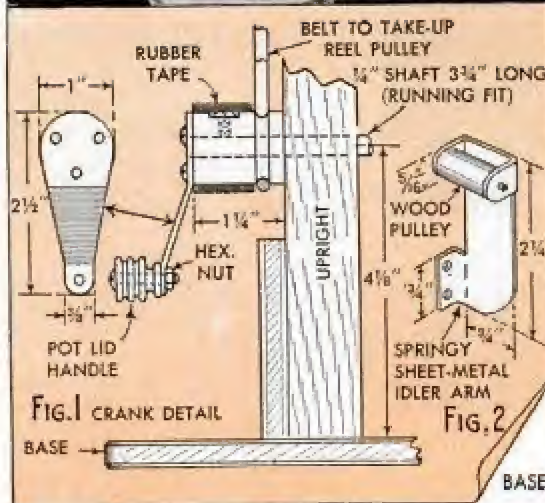
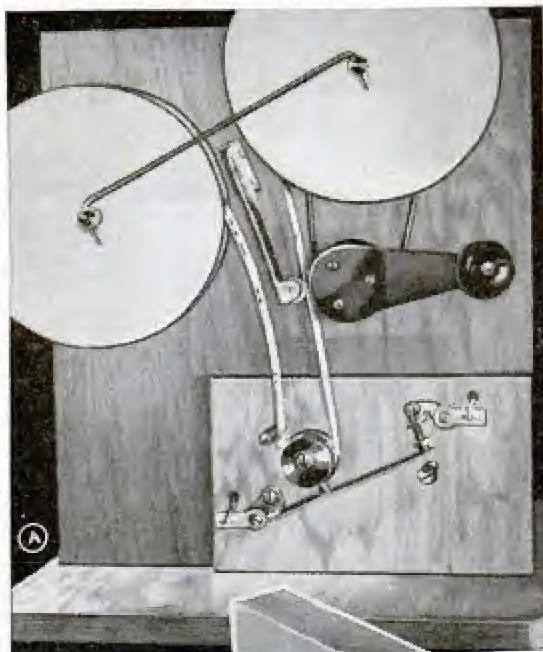
# TAPE-OPERATED CODE SENDER

By Walter E. Burton

**B**UILT almost entirely from common scrap materials, this automatic code sender speeds up the process of learning to receive radio code. It may be operated by hand or driven with a sewing-machine motor, the speed of which can be controlled by a rheostat. It employs a perforated tape  $\frac{1}{2}$  in. wide. Such tape may be obtained already prepared, or in blank rolls that can be hand punched to form dots and dashes; standard ticker tape may be used. As the spring "finger" slides in and out of the perforations in the tape, the contact arm provided with an auto-ignition breaker point, completes the circuit through a flashlight cell and operates the buzzer.

Photos A, B, D and E show various steps in the assembly. General construction details appear in Figs. 1, 2 and 3. The 1-in. crankshaft pulley in Fig. 1 is covered with electrician's tape, held with rubber cement.

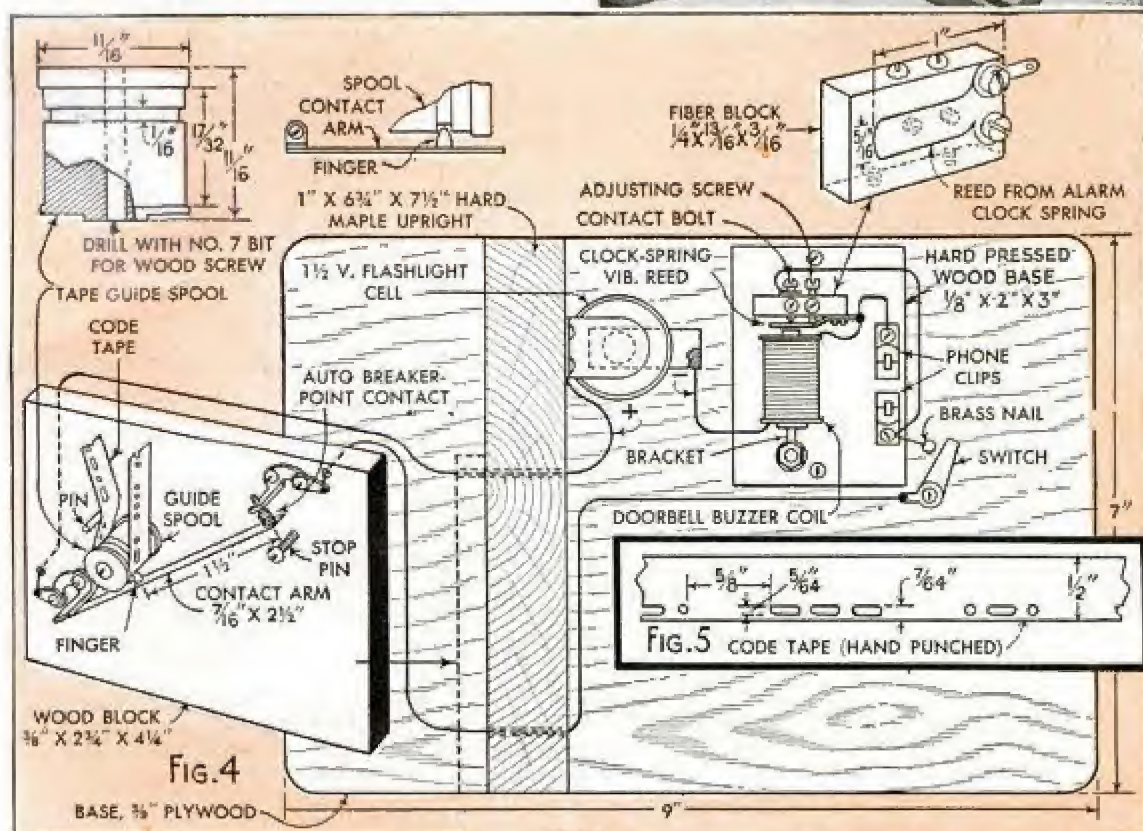
The sending mechanism and buzzer circuit wiring details are given in Fig. 4.





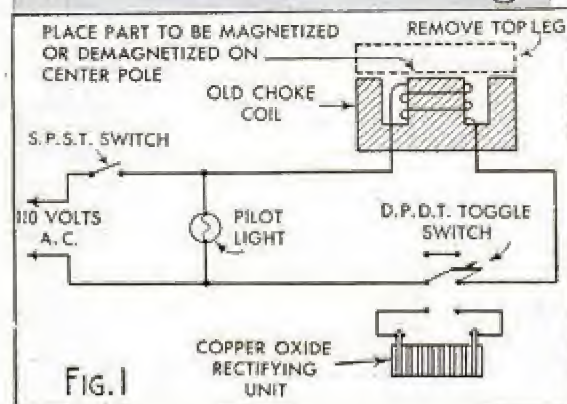
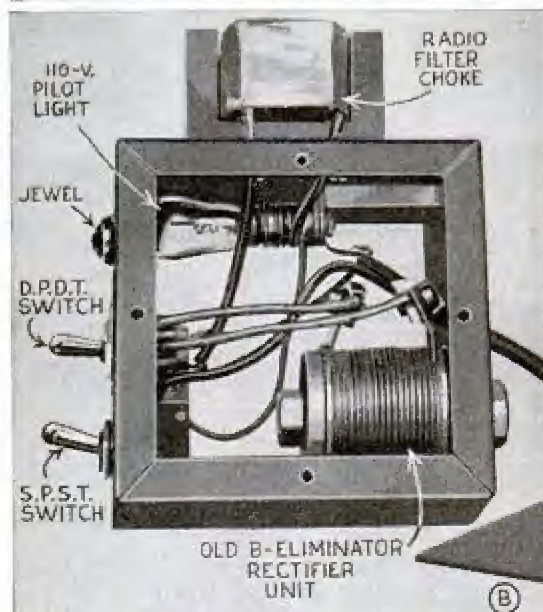
# MADE FROM SCRAP MATERIALS

Mounting posts for the contact arm and upper contact were prongs taken from a broken lamp cord plug. The contact arm may be cut from a piece of bronze weather stripping, or shim stock. Solder one end to the lower mounting post as shown in Fig. 4. Both contact points were salvaged from an old automobile distributor; one point was removed from the breaker arm with heat, and soldered to the free end of the contact arm. The other point mounted on a machine screw in the upper mounting post, is adjustable. The "finger" is formed in conical shape from  $\frac{1}{4}$ -in. brass rod and soldered to the arm; a spool-shaped tape guide was also turned from scrap brass. This spool and the "finger" must be smooth. The tape reels, shown in photo C, are made from wood and stiff cardboard disks as detailed in Fig. 3. These ride on projecting shafts, the ends of which are drilled to take a wire guide clamp. The buzzer can be made as shown in Fig. 4 or any small high-frequency buzzer may be used. Tape punching details are given in Fig. 5. The holes may be made with a ticket punch that makes a round hole  $\frac{3}{64}$  in. in diameter. A  $\frac{3}{32}$ -in. nail set may also be used as a punch if the tape is backed with hard pressed wood. The dashes are 3 overlapping holes.





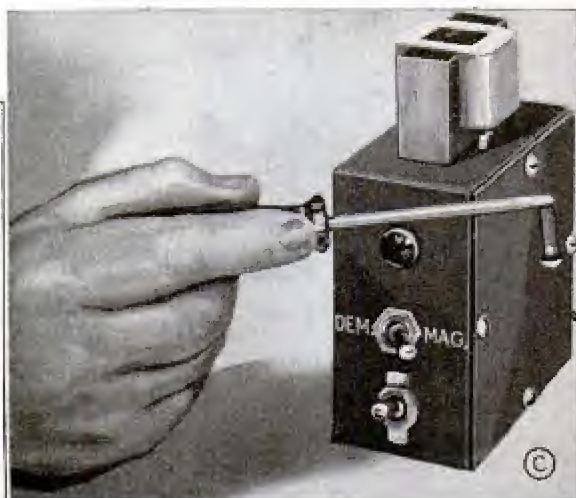
# Magnetizing Control Unit From Radio Parts



ONLY a handful of junk-box parts were required to assemble this handy little gadget that is especially useful in radio repair shops, on jeweler's workbench and in classrooms where magnetism is being taught. It can be used to magnetize a screwdriver, as shown in photos A and C, so that it will hold steel screws for easy starting in difficult places in radio chassis assemblies or cabinets. It will pick up tiny steel screws and retrieve valuable metal parts that fall into hard-to-get-at places. On the other hand, when a magnetized tool becomes a nuisance it can be demagnetized quickly and completely with the same device by merely flicking a double-pole double-throw toggle switch. This feature is useful in keeping filings and small cuttings off twist drills and files; and is very necessary where jeweler's tools and watch parts must be completely demagnetized.

The construction details are clearly shown in photo B, and the circuit diagram Fig. 1. Any filter choke coil salvaged from a discarded radio set may be used. The top leg is removed from the iron core; the choke has a resistance of 350 ohms but this is not critical. A copper-oxide rectifier unit of the type commonly used in old style A and B-eliminators and battery chargers is connected to one side of the d.p.d.t. switch so that the half-wave rectifier will be connected in series with the choke coil which acts as a magnet thus creating a d.c. magnetizing field. The other side of this switch is shunted so that nothing but a.c. current flows in the circuit when in the demagnetizing position. Thirty seconds is sufficient time for magnetizing or demagnetizing any tool or part.

The metal case is 4 in. long, 4 in. wide and 2 in. deep; any similar wood case may be used. A 110-volt pilot lamp is optional.





*Movie Hero? No-no—it's his*

# Pipe Appeal

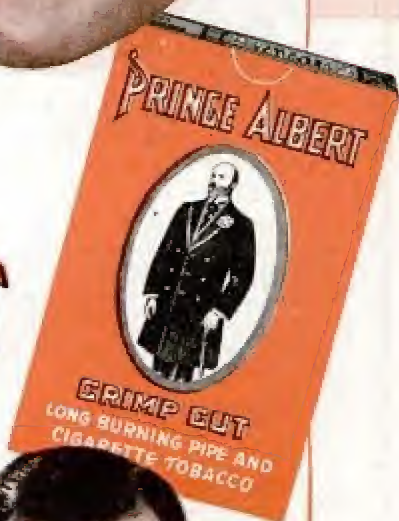


"*PRETTY SPECIAL!*" women say about the man who smokes a pipe. *Super-special*—when Prince Albert's in the bowl. They go for its *delightful fragrance, aroma*. You'll go for its *rich, tobacco-y taste* that comes through so *mild and mellow*, so easy on your tongue. Crimp cut for proper packing, smooth, even drawing. P. A. for all-round PIPE APPEAL!



## PRINCE ALBERT

THE NATIONAL JOY SMOKE



**50** pipefuls of fragrant tobacco in every handy pocket package of Prince Albert

**70** fine roll-your-own cigarettes in every handy pocket package of Prince Albert

*Tongue-tired? Try*  
**P.A. for RICH TASTE**  
*that's plenty*  
**MILD, smooth!**



BUY  
WAR  
BONDS  
AND  
STAMPS

R. J. Reynolds Tobacco Company, Winston-Salem, N. C.



# PLUGS FOR THE TRUCKS OF CHINA



When you learn of fresh action on the China front, you can be sure that motor trucks from the U. S. A. are "in there—pitching." And, they *must* get through.

Thousands of the trucks are equipped with the same make of spark plugs, oil filters, and fuel pumps which has served America so well, so long. They wear the AC emblem, which is known as a symbol of good engineering, trustworthy performance, and precision manufacturing.

## Conservation HERE Means Victory Over THERE

In order that military vehicles, planes, and ships may have all the AC Spark Plugs, Oil Filters, and other products needed, we here at home, cannot have as many.

Let your repair man conserve your transportation by keeping your AC devices in condition. When replacement is necessary, select AC—for continued satisfaction.

AC SPARK PLUG DIVISION  
GENERAL MOTORS CORPORATION

BUY WAR BONDS—AND BRING VICTORY QUICKER



## Flying Trouble Shooters

(Continued from page 69)

kered and experimented. He found the trouble, and soon R.A.F. planes were in the air again over Russia.

With machine shops often unavailable, and with tools and parts often missing, field servicemen are past masters at the art of improvisation. For overhaul, a husky tree and a block and tackle substitute for an engine stand. For propeller work, empty oil drums are almost as good as movable scaffolds. Leading edges are repaired with little more than baling wire and a prayer. A 24-inch rip in an inner tube was sewn up the way you'd sew a rip in your shirt!

Down in Australia where American, Australian, New Zealand, Dutch and British pilots are fighting the Japs, it's the same story. Every plane that crashes is salvaged. The downed plane may be miles from any habitation, but eventually a bulldozer will crash through the jungle or a truck will come chugging through the desert to salvage the spare parts. Army mechanics boast that given a smashed fuselage, they can build a complete plane in the jungle.

In the China-Burma-India theater, engineering servicemen wear commissioned officers' uniforms—minus any insignia. They are given all the privileges of officers and the responsibilities that go with them. Although noncombatants, they are subject to military regulations. Many of them have been machine-gunned and bombed.

So successful has been the work of the factory servicemen in the China area, where spare parts are even scarcer than Australia, that very few planes have been lost through engine trouble. In China, the factory men have taken on the job of teaching young Chinese to service planes. The lads are eager students and show a natural aptitude for fixing up the machines.

Men selected as engineering service representatives often come up from the ranks of skilled workers in factories. An engineering background helps—but is not absolutely necessary. After a man is chosen, he must undergo a special training period at the factory of from 10 to 12 weeks. Graduating from that, he is given an assignment somewhere within the United States as a junior service representative. After about six months on domestic assignments, he is qualified to be sent overseas. By that time he should be able to take a plane apart in a blinding sandstorm and put it together with baling wire, toothpicks and pliers.

With thousands of planes a week rolling off America's assembly lines, the job of the

(Continued to page 148)





*"We are proud to pay tribute to the added efforts of our employees which have made Defoe's war record possible. Industrial know-how, plus willing workers, will win the war and assure an even greater post-war America!"*

HARRY J. DEFOE  
Founder, Defoe Shipbuilding Co.

# From Sugar Beets

## TO WARSHIPS

**F**OOD and warships are vital weapons. So forty-seven per cent of the employees at Defoe not only do a full stretch of work in the shipyards, but operate their own farms as well. These farmer-workers are helping to beat the Axis by building warships and also by producing bumper yields of sugar beets and other crops.

They typify the spirit of extra accomplishment which is responsible for our record-breaking production of destroyer escort ships to help crush the U-boat menace.

*The unique Defoe method of building these 1700-ton ships upside down and then rolling them over to complete their construction has doubled man-hour production. This enables twice as many*

*destroyer escort ships to be built at half the labor cost per vessel.*

Independent of government financing, Defoe is building DE ships for the Navy on a fixed-cost basis. This program is not only saving the government millions of dollars, but priceless days in delivery time.

When the Axis is defeated, the peace-time application of our organization, war-born technical experience and advancements will provide products of better quality and at lower cost for the American consumer.

### BACK THE ATTACK—BUY WAR BONDS

Defoe workers take more than 10% of their pay in War Bonds.

DEFOE SHIPBUILDING COMPANY,

BAY CITY, MICHIGAN

# Defoe

*Three White Star Renewal Citations now decorate the Navy "E" Award won by Defoe workers.*

**Ships for Victory  
Servants for Peace**



*Now ONE in Name*

**MILLERS FALLS  
TOOLS**

SINCE  
1868

**GOODSELL  
PRATT**  
1500 GOOD TOOLS



THE QUALITY which has always been symbolized by the Goodsell-Pratt trademark lives on under the Millers Falls name. One in quality for generations — one in production and management since 1931 — Goodsell-Pratt precision tools now carry the company name — Millers Falls. Only the trade-name is changed.

So when you buy, insist on the name Millers Falls.

**MILLERS FALLS  
TOOLS**

SINCE  
1868

**MILLERS FALLS  
COMPANY**

**Greenfield, Mass.  
U.S.A.**

engineering serviceman has become too large for the factories themselves to handle. Recently, many aircraft companies have established special "wrench and pliers" colleges for Army mechanics. For example, each month hundreds of graduates of Army basic mechanic schools are sent to the North American Aviation Corporation's plant at Inglewood, Cal., to get specialized training on the B-25 Mitchell bombers, the P-51 Mustang fighter and the AT-6 combat trainers. Factory experts serve as lecturers. Motion pictures, slides, demonstration boards and actual planes are used for instruction purposes.

Recently a plan was inaugurated whereby each Army student studies a plane during its final stages of construction. When it leaves the factory he goes with it to whatever battlefield it is assigned. In this way, the plane becomes almost personal to him and he takes great pride in its upkeep.

With 90,000 planes produced in the United States in 1943 and some 115,000 promised for 1944, keeping them all flying and fighting is a job of major proportions. Behind them all stands the engineering service representative—whether he be teaching a class of Army mechanics, putting A-20 propellers on a Flying Fortress or reporting the performance of P-38's over Rabaul.

## Five-Man Whirlwind

(Continued from page 81)

Ten championship team last year. When he shoots, his feet are always pointing in the direction of the basket, weight evenly distributed on the balls of both feet. His eyes are on the front rim of the basket, knees slightly bent, fingers holding the ball slightly behind the axis, elbows close to his sides. He delivers the ball with a simultaneous action of the entire body, and the arms follow through in the path of the delivery. This is perfect form.

By some sixth sense, a good player knows when he can make a basket. I always tell the boys to shoot whenever they think they can sink one, whether they are in the center of the floor or within easy range. This advice almost gave me heart failure at a Madison Square Garden game in 1941. Our team had made 22 free throws without a miss. With this record in our hands, one of the guards, Vic Wukovits, was fouled in the closing minutes of play. He had the option of trying the free throw or taking the ball out of bounds. While his teammates stood frozen in their tracks and I held my breath, Vic took the free throw and a chance on ruining the perfect record.

(Continued to page 150)



There's been  
a  
big change



JUST as the rhumba replaced the polka, "cageless" roller bearings have found their place in the more exacting world of today.

Tyson's "All-Rolls" design startled bearing manufacturers. "It can't be done," they declared . . . But Tyson

did it—perfected a tapered roller bearing with *thirty percent more rollers*.

And with these extra rollers, Tyson established a new maximum in bearing efficiency—greater load-capacity, more strength and rigidity, longer life. *The big name in bearings today is...TYSON!*



TYSON BEARING CORPORATION, MASSILLON, OHIO

COUNT THE ROLLS • THE ROLLS COUNT



**Tyson**  
TODAY'S HEAVY-DUTY BEARING

★ BUY MORE WAR BONDS ★



## SPEED MACHINE SAW FILING with Nicholson File Holders (POINT AND TANG HOLDERS)



*They simplify rotating, removing, replacing and positioning of file.*

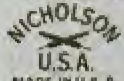
**N**ICHOLSON File Holders for repetitive filing are a great improvement over methods which involve infinite making and undoing of adjustments. No hand-and-hammer wedging of file into holders! No "unwedging" or loosening of set screws to turn or remove file! No repeated hand gauging! Note this simple, methodical procedure:

**INSERTING FILE.** Push back spring plunger of point holder. Insert tang. Triangular socket engages file at precision-formed surface, not at less accurately forged tang. Insert point; release plunger. Position file; tighten set screws. Once does it—for entire job.

**TURNING FILE.** Push file forward to disengage shoulder end. Rotate file for fresh cutting edge. Release plunger; file springs back. All set to go again!

HOLDERS available for every size triangular file. COMBINATION BRACKETS to fit all standard saw-filing machines—Anderson, Cleveland, Foley, Seigmeister, Wardwell, etc. Consult any mill-supply house handling Nicholson or Black Diamond Files—or write us direct.

Nicholson File Co., 22 Acorn St., Providence 1, R. I., U. S. A.  
(Also Canadian Plant, Port Hope, Ontario)

**NICHOLSON**  
**FILES** FOR EVERY  
PURPOSE  **NICHOLSON**  
U.S.A.  
MADE IN U.S.A.

His shot was perfect. I asked him afterward why he took the chance. He said there wasn't any chance about it. He just knew he could make the shot and he did.

Basketball stars are as superstitious as major league baseball players. One of our recent players always grabbed his socks and pulled on them as hard as he could before trying a free throw. The Navy flier who had butterfly trouble, had the habit of washing his hands just before the start of every game and every half.

Basketball is truly America's own game. The story of its origin on a December day in 1891 when Dr. James A. Naismith nailed up a peach basket in a Y. M. C. A. has been told a thousand times. In the intervening years, the game has grown until today it is a major sport in hundreds of colleges and high schools. Countless teams represent clubs, churches and other organizations.

Although many of the basketball stars are doing their shooting with Garands and machine guns this winter, coaches are managing to turn out fair teams. Because the coaches aren't as particular as Uncle Sam, you can play with a punctured ear drum and other minor defects. The fastest basketball player I ever coached was rejected by the marines because of bad feet.

One prediction I'd like to make for the postwar era: Basketball will still be America's most popular game.

## Railroading in the Clouds

*(Continued from page 37)*

to couple two locomotives back to back, with a rotary plow at each end. This outfit can plow its way along the track to a point where an oncoming train is encountering heavy snow, and then reverse itself and plow back over the same rails to clear the way for the train.

Summer or winter, in clear weather as well as bad, there is always the job of getting trains safely down the other side of the Mountain after they have climbed to the top.

Lightly loaded cars are made up into the same train that contains heavily loaded cars to provide a sufficient number of wheels in contact with the rails for braking purposes. The peak traffic that is being moved both east and west over the Mountain these days is just an example of the job that all of America's railroads are doing. Freight trains are hauling more cargo faster than ever before and yet even their stepped-up speed is not always fast enough to suit the needs of war. Machinery that started west as ordinary freight may sud-

*(Continued to page 152)*





INDIAN  
TRAIL BLAZERS



## Voyager of Discovery

Make your voyages of discovery to America's scenic wonders on an Indian Motorcycle. No other form of transportation can wing you so easily and economically to hard-to-reach places. Your Indian seems part of you as it flashes effortlessly... with unbelievable smoothness... over thrilling miles of highway and byway. In the saddle of this modern mustang you ride with confidence and safety... with the glorious wind of freedom on your face!

Look forward to the day when you and your Indian can go adventuring together in a peaceful America.

### INDIANS ON THE WARPATH

Right now, all new Indian Motorcycles go straight to war, and what a fighting record they're turning in! But new, improved, postwar Indians are already being blueprinted. *They're the motorcycles to wait for!*



**BUY WAR BONDS NOW  
TO BUY AN INDIAN LATER**

Indian Motorcycle Company  
Springfield, Massachusetts

# Indian

## MOTORCYCLES

Mail FREE copy of exciting Indian News.

Name.....

Address.....

City.....State.....



# Tool Tips by **STANLEY**

## PROPER USE OF COLD CHISELS

You can make cleaner cuts, save yourself work, and get more service from your cold chisels if you use the right type for the job and know how to handle it. Here are a few tips:

**Lubricate chisel point only when chipping wrought iron or steel.**

**Use a narrow chisel to cut holes, and save filing.**

**Use a cape chisel to cut off rivet heads.**

There are plenty more helpful hints in the **STANLEY TOOL GUIDE**, a 32-page handbook of instructions on the care and use of tools for the home craftsman. Simple explanations, hundreds of illustrations. Write for a copy today.

**Tools are vital to Victory . . . make them last!**



*A Big Value  
for only 25¢*

Write for your copy today.

### STANLEY TOOLS

DIVISION OF THE STANLEY WORKS  
105 ELM STREET

New Britain, Conn.

denly be needed at its destination in a matter of hours instead of days. Or a change in military plans may mean that a few hundred pounds of some vital substance, in a box car somewhere between Kansas City and Sacramento, must be loaded tomorrow night on a ship leaving San Francisco. Problems such as these are turned over to a gang of cargo hunters, specialists who have been trained to discover the whereabouts of any car in any particular train at that exact moment. Possibly the needed car is a few miles east of El Paso or Ogden. At once the orders go out to halt the train long enough to transfer the needed material to an express car that can be attached to a high speed passenger train, or loaded into an air freighter if the emergency is grave enough.

## How Good Are Jap Weapons?

*(Continued from page 64)*

enigma itself. No mortar shell ever seen by United States Army Ordnance officers resembled this black cylinder, 11 $\frac{1}{16}$  inches long. The only way to examine it was to fire it. The projectile was dropped into the muzzle of the mortar. With a great puff it rose 1,500 feet, and at its maximum elevation, literally blew its top. Seven metal cylinders 6 $\frac{1}{2}$  inches long were shot from the case, and each ejected a three-inch black cylinder suspended from a paper parachute. Those cylinders were deadly booby traps. The string which suspended them passed through a silk cloth and into the top of the cylinder. Pull that string and the booby trap would explode.

Is the Jap 75mm. antiaircraft, antitank gun good? This Model 1928 gun, sitting high on its grotesquely camouflaged pedestal doesn't look as though it could shoot the top off a barn from the inside, but a certain first lieutenant could tell you how deceiving the appearance of Japanese materiel can be.

Fire control data is set in manually. The gun has a vertical range of 33,000 feet, horizontal range of 45,000 feet, elevation of 85 degrees and a traverse of 360 degrees. It can be fired at about 12 rounds a minute. It looks crude, ineffective, but that lieutenant who was there tells a different story.

His company was bivouacked about five miles from some Japanese-held mountains on an Aleutian island. He had heard that Japs are expert artillerymen. "If they can see you . . . they can hit you" he'd been told, and on this flat plain he was reasonably certain the Japs could see his company.

"I warned them repeatedly," he said, "not

*(Continued to page 154)*



HERE'S THE ANSWER TO YOUR

*Cold Weather Starting Troubles*



## CASITE GUARANTEES

SUMMER STARTING IN WINTER WEATHER

OR *"Double Your Money Back"*



● Casite has eliminated cold-weather starting trouble for over a million car owners. It will do the same for you.

Added to the crankcase, it keeps oil free-flowing, enables motors to start faster, with less battery drain even in sub-zero weather.

Casite improves motor efficiency in other ways, too: It cleans out power-destroying, fuel-wasting sludge deposits, retards the formation of engine varnish, frees sticking valves and rings, and gives better and smoother performance *all the year around*.

Save your battery! Save your motor! Get Casite today from your car dealer, service station, or garage.

### *Remember . . .* CASITE GUARANTEES

That any motor capable of being started in a warm room will start in the coldest weather when Casite is added to crankcase. Add Casite according to instructions. If your car fails to start, you get double your money back by filling out guarantee certificate and mailing to The Casite Corporation, Hastings, Michigan. Maximum refund is \$1.30 per pint, which is twice nationally advertised price of Casite.

THE CASITE CORPORATION • HASTINGS, MICHIGAN



# CASITE

CLEANS OUT MOTORS  
KEEPS MOTORS CLEAN

*It's a  
Privilege  
to Buy  
War Bonds*

GET CASITE . . . AND GO!





## BY "YANKEE" TOOLS

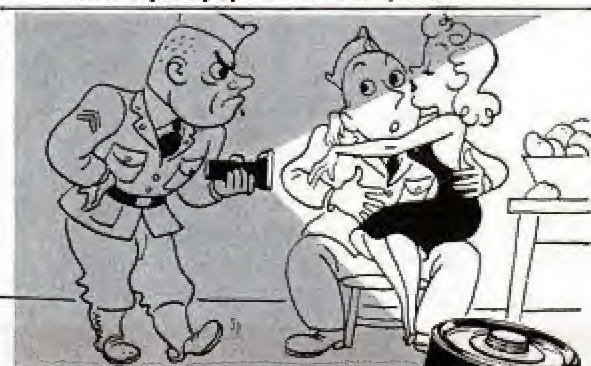
Time saved in the Battle of Production shortens the days to Victory . . . and "Yankee" Fine Mechanics' Tools save time. A minute here and a half-minute there seem unimportant in themselves. Multiplied by the thousands of "Yankee" Tools in service, they total hundreds of man-hours. . . . For nearly half a century, "Yankee" on tools has been the mark of ingenious and dependable performance—of faster and easier work on countless jobs. Safeguard your "Yankee" Tools. They are weapons of war and must be treated right. And when they again become tools of peace, you will find them immediately useful for your post-war needs.

## "YANKEE" TOOLS

*make good mechanics better*

North Bros. Mfg. Co., Phila. 33, U.S.A.  
Established 1880

Makers, also, of "Yankee-Handyman" Tools



He was assigned to do KP  
This most romantic guy  
It looks as tho he thought KP  
Stood for Kutie Pie



You can't buy them as before  
When it's over there'll be more

to bunch up at the kitchen. But you know how we are when nothing happens for a while, we get careless.

"One evening about 30 of our men ganged into the kitchen for coffee. Some Jap with a telescope was waiting. They fired one round—that's all. It must have landed in the coffee urn. Five wounded, ten killed. The Japs are good artillery gunners—if they can see what they're shooting at."

Probably the most accurate and generally effective piece in the whole Japanese repertoire of arms is the now famous Knee Mortar. Strictly speaking, it is not a knee mortar. A Marine on Guadalcanal who captured one, proved the misnomer by trying it against his knee; he broke his leg. The spade at the bottom is designed to be implanted in the ground, or against a tree—not on the knee!

## River Wranglers

(Continued from page 87)

war particularly has sent the rate of river travel far above what it was in World War I.

Army Engineers point out that their projects may be multi-purpose; in planning for flood control they also study all possible uses of the water—in reclamation, irrigation, power, and creation of wildlife refuges, for instance. Or, the original flood-control project may be erected with an eye toward modifying it for other uses in the future, if desired.

Flood-control programs are always changing. The job is never done. Rivers build up sandbars that must be dredged away; channels must be kept straight and deep; levees must be kept in repair. As the Mississippi River Commission reported to Congress:

"It would be rash to say that the plans as now approved, or even as they may be modified in the near future, are a complete and final answer to the flood and navigation problems in the valley.

"The present project is by way of being a first line of defense, thrown up as rapidly as resources have permitted over an extremely extended front, and affording the essentials of protection.

"It should be the task of future years to strengthen and consolidate the line, increasing its present margins of security, impressive though these are in comparison with prior standards."

Only by waging a constant campaign can the master plumbers keep the river away from the American door.

¶To learn where to buy commercial products described in these pages, see the index.



# You owe it to your Uncle Sam!

*He needs manpower—every available person. A hearing deficiency may keep you out of the armed forces... but you can do your fighting on the home front... in war materiel plants. A good hearing aid enables you to go all out in the war effort. The movement is growing. In our plant today are workers wearing hearing aids and contributing as competently as if their hearing were normal.*



## The New Zenith RADIONIC HEARING AID

**\$40.00** READY TO WEAR

Complete—with Radionic Tubes—Crystal Microphone and Batteries  
... Liberal Guarantee

Zenith has built the best that modern knowledge and radionic engineering make possible into this \$40.00 hearing aid. It has no other models... one model... one price... one quality.

## You owe it to your friends!

They want to enjoy your company as much as you do theirs. Your hearing aid means as much to them as it does to you.

## Are you really doing your part?

That question only *you* can answer. *Think!*

☆ ☆ ☆ ☆ ☆ ☆ ☆ ☆ ☆ ☆ ☆

## Report on a Revolution

Zenith recently started a revolution—to reduce the cost of hearing. After years of research and preparation, the Zenith Radionic Hearing Aid is now offered to the public.

The price—\$40—(about one-quarter that of other good vacuum tube instruments). Complete—ready to wear—with miniature radio tubes, crystal microphone and batteries—liberally guaranteed.

Inquiries from everywhere have flooded the mails—telephone calls—telegrams.

A sales volume—unheard-of in this field—is gaining daily momentum—and is a demand created by

self-evident merit of the instrument itself. Today our problem becomes one of production and distribution—to as quickly as possible make the Zenith Radionic Hearing Aid available in all localities.

We are doing our best to furnish additional manpower for Uncle Sam's production forces. And—in the doing—we are experiencing that rare satisfaction born of directly contributing to the welfare of individuals.

THE ZENITH HEARING AID WILL BE AVAILABLE THROUGH REPUTABLE OPTICAL ESTABLISHMENTS FRANCHISED BY ZENITH. (NO HOME CALLS OR SOLICITATIONS) Write us for address of outlet nearest to you.

☆ ☆ ☆ ☆

There are cases in which deficient hearing is caused by a progressive disease and any hearing aid may do harm by giving a false sense of security. Therefore, we recommend that you consult your otologist or ear doctor to make sure that your hearing deficiency is the type that can be benefited by the use of a hearing aid.

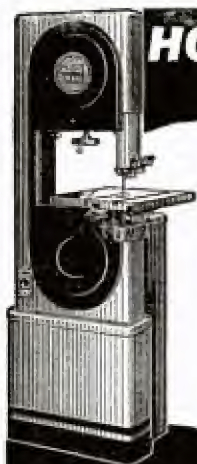
### TO PHYSICIANS:

A detailed scientific description will be sent upon request. Further technical details will appear in medical journals.

Write for Free Descriptive Booklet  
ADDRESS DEPT. PM-2, HEARING AID DIVISION  
**ZENITH RADIO CORPORATION**  
CHICAGO 39, ILLINOIS







## HOW TO OBTAIN SHOP TOOLS

at the earliest possible moment and  
**PAY FOR THEM OUT OF  
PATRIOTIC SAVINGS  
IN WAR BONDS**

Own versatile, low-cost, sturdy

**Boice-Crane**  
Band Saws - Saw Jointers  
Jig Saws - Spindle Shapers  
Belt Sanders - Spindle Sanders  
Drill Presses - Lathes  
Thickness Planers

Write today for folder on the

## Boice-Crane **PURCHASE PRIORITY PLAN**

a safe, convenient plan for forward-looking shop men and home craftsmen.

With manufacturers now engaged 100% in war production, the pent-up demand for shop tools is tremendous. You can avoid prolonged waiting for your tools, or the necessity of buying something less satisfactory, by reserving a preferred delivery position now. Use this convenient coupon to get details.

**BOICE-CRANE CO.**  
943 Central Ave., Toledo, Ohio

Please send, without obligation or cost, details of the Boice-Crane Purchase Priority Plan, together with a copy of your catalog on shop tools.

NAME \_\_\_\_\_

STREET \_\_\_\_\_

CITY \_\_\_\_\_

## New Designs in **FRANZITE GRIPS**

**Modernize Your Gun! Improve Your Score!**

Most durable grips made. Positively unbreakable! For Colt, Smith & Wesson, Hi-Standard, Ortgies, Luger & Mausers in a wide choice of beautiful designs in ivory, pearl, walnut, onyx, etc. Low prices. **FREE CATALOG.** Dealers Wanted.

**SPORTS, INC., (Mfrs.) 2850 N. Clark St., Dept. P-2, Chicago, Ill.**



## ONAN

**ELECTRIC PLANTS**

**Electricity for Any Job - Anywhere**

**ONAN GASOLINE DRIVEN ELECTRIC PLANTS** provide electricity in locations where it is not otherwise available, and for emergency standby service. Thousands of units are doing a winning job in the war.



Sizes from 350 to 35,000 watts.  
A.C. 50 to 800 cycles, 110 to 560  
volts, D.C. 6 to 4000 volts. Also  
dual A.C. and D.C. output models.

Details gladly furnished.

**D. W. ONAN & SONS**

1090 Royalston Ave.

Minneapolis, Minn.

## Crash Boats to the Rescue

(Continued from page 31)

additional portions of the plane that might be reconditioned. An engine or heavy machine gun may be partly broken up in a crash but a few hours in salt water does it no particular harm, provided it is disassembled, washed with fresh water, dried, and greased soon afterward. The unharmed parts can be put together again. The delicate parts of the aircraft instruments are usually smashed in a crash, of course, and yet the cases and many of the parts can be used in assembling new instruments.

One of the crash boats always stands by during take-off or landing operations of large naval flying boats, and crash boats are always sent out to search the landing area for floating debris before large flying boats are due to land. The Navy's crash boats, too, play their rescue roles frequently in the case of ordinary water accidents, such as capsizing rowboats or disabled power boats that are drifting aground. The ability of the boats to get to the scene of an accident in a matter of minutes has helped the rescue crews save many lives.

It's not important, but the fact is that there is little if any expense attached to the men and equipment that the Navy keeps tied up for emergencies. Their life saving job doesn't cost a cent, for the value of the materials that are salvaged through their efforts balances the books.

## Up Where the Oxygen Ends

(Continued from page 11)

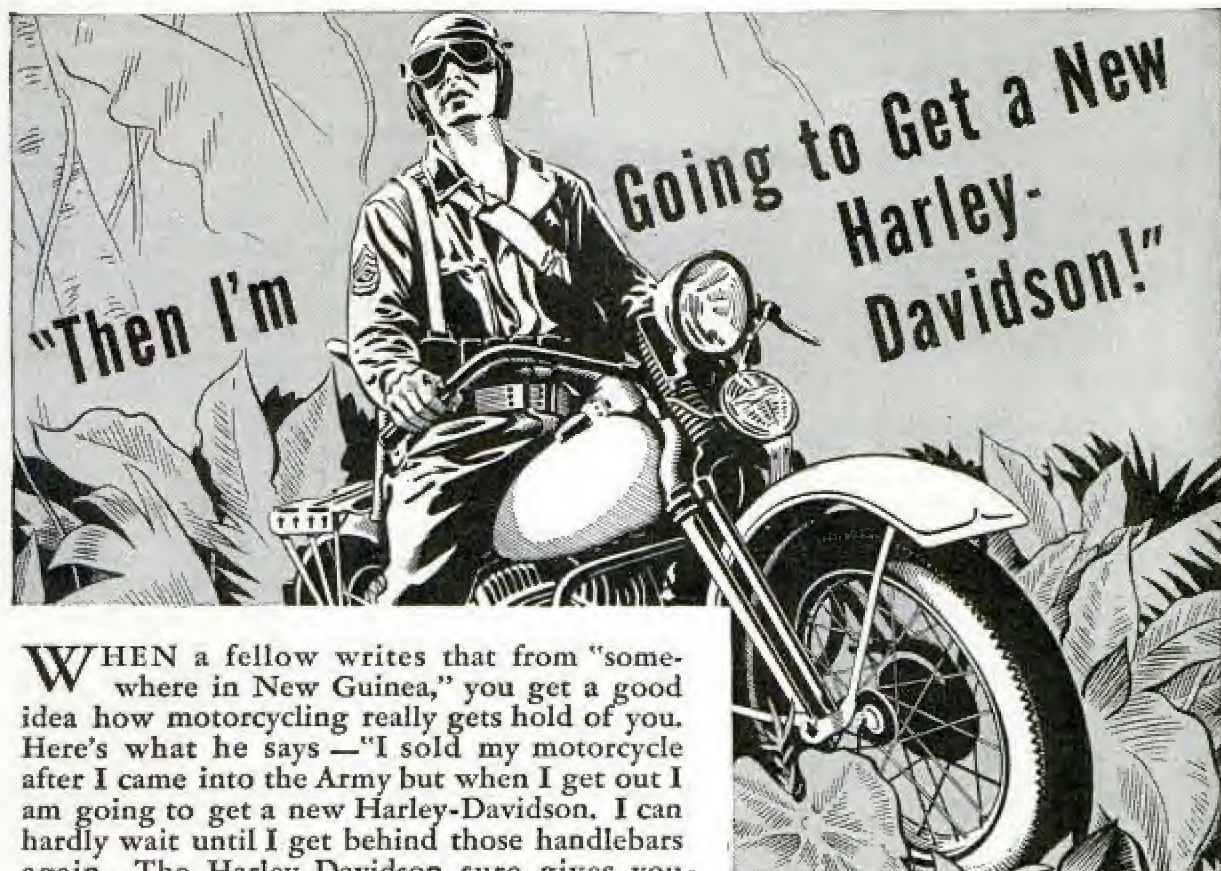
started doing some uncalled for aerial gymnastics, endangering other ships in his flight. At no time was he aware that he wasn't doing the finest flying of his life. The other fliers in the formation quickly sensed what was wrong and carefully led him to a lower level where he soon recovered his judgment.

Today any cadet can tell you how many seconds of consciousness he will have left at almost any level if his oxygen equipment fails. For example, at 30,000 feet he would have 43 seconds; at 35,000 feet, 25 seconds, and 40,000 feet, only 15 seconds.

Until a few months ago, it was not known whether a man could leave his ship in an open parachute at 40,000 feet and live. The substratosphere pioneer who solved that problem was Lt. Col. W. R. Lovelace, acting director of the Wright Field aeromedical laboratory. He stepped off the bomb bay platform of a Flying Fortress at 40,200 feet—his first jump!

(Continued to page 158)





WHEN a fellow writes that from "somewhere in New Guinea," you get a good idea how motorcycling really gets hold of you. Here's what he says — "I sold my motorcycle after I came into the Army but when I get out I am going to get a new Harley-Davidson. I can hardly wait until I get behind those handlebars again. The Harley-Davidson sure gives you economical transportation. So until this is over and I am back in the saddle, keep them rolling."

You bet, Dave — we're keeping 'em rolling to the armed forces so you'll be back home sooner. And in the race meets, gypsy tours, hillclimbs and endurance runs to come, war-proved Harley-Davidsons will be out in front! Lots of fellows are buying War Bonds now — to get new Harley-Davidsons after Victory!



## HARLEY-DAVIDSON MOTORCYCLES

**HARLEY-DAVIDSON MOTOR CO.**  
Department P, Milwaukee 1, Wisconsin

Please send at once free copy of 24-page  
"Enthusiast" Magazine, filled with motor-  
cycle action pictures and thrilling stories.

Name

Address

City  State

**SEND COUPON  
NOW**





## Cushman

America's speed in equipping herself for war has amazed the world! One reason is that whole fleets of powerful little CUSHMAN Motor Scooters zip through many great war-time plants, saving time and manpower.

Where several foot messengers formerly delivered mail, orders, messages—one CUSHMAN now does the job! Where precious time was lost as inspectors, officers and others walked long distances, CUSHMANs now get them there in a hurry! It's convenient! It's economical! It's easy to stop and park anywhere!

**WAR NEEDS TAKE COMPLETE OUTPUT!** The CUSHMAN has so thoroughly proved itself under terrific wartime pressure that our complete output—greatest in our history—is being taken by these big plants—and by the Army, Navy and Air Forces, at home and at the front!

**WORTH WAITING FOR!** Your dealer can't supply you without a high priority. But you can bank on this—today's tough wartime experience is developing CUSHMAN improvements which will insure you a still more sturdy, dependable machine—when it is again available!

Help bring that time nearer—Buy More War Bonds!  
**CUSHMAN MOTOR WORKS, Dept. P-6, Lincoln, Nebr.**

## SYN-FLO...

### A NEW MAGIC LIQUID-PLASTIC ENAMEL

- ★Finishes walls like TILE
- ★Finishes woodwork like PORCELAIN

This is really it! Modern science has produced this new white PLASTIC coating you apply with a brush. It actually has the same chemical properties of genuine molded plastic products.

#### A BRUSH-ON PLASTIC

With an ordinary brush you flow this coating on your woodwork and it dries to a smooth porcelain finish—hard, water-proof, abrasion-resistant—stays brilliant white.

You won't have to wait until after the war for this new, scientific, plastic discovery. Limited quantities now available.

#### MONEY-BACK GUARANTEE

One gallon SYN-FLO Liquid Plastic will cover walls of average room. Send only \$5.95 for full Gallon SYN-FLO with Special Thinner, express prepaid. Will ship C.O.D. if desired.

LIMITED SUPPLY AVAILABLE  
 TO PUBLIC NOW. ORDER AT  
 ONCE! FREE ILLUSTRATED CIR-  
 CULAR ON REQUEST.

**SUPERIOR PAINT AND VARNISH WORKS**  
 2256-2274 N. Elston Ave., Chicago 14



His parachute opened with such a terrific jolt that he was knocked unconscious, both heavy outer gloves were lost, and a snug fitting silk glove was torn from his left hand. The temperature was —49 degrees Fahrenheit. Col. Lovelace recalls an altimeter reading of 30,000 feet, looking down to see the earth getting closer, and sucking in oxygen from the bail-out bottle. He landed safely in a wheat field with plenty of oxygen to spare. His only injury was a frost-bitten hand. The worst part of it, he said, was the 45 seconds he stood on the bomb bay platform before stepping off.

Some of the things Col. Lovelace learned were: You can jump from 40,000 feet and live. The jerk of the opening parachute will force all the oxygen from your lungs and a bail-out cylinder of oxygen is essential. The shock of the parachute opening can be eased if you fall free until the forward momentum of the plane is lost.

You can reach the earth with an open parachute drop from 40,200 feet in just 23 minutes and 51 seconds. The colonel was pleased that this time lapse was close to the laboratory estimate of 24 minutes and 32 seconds for a drop from 40,000 feet. A "free fall" from 40,000 feet would take only three minutes and four seconds.

All the trouble that man has gone to in his successful invasion of the substratosphere would indicate that there are some pretty good reasons for taking the trouble. There are. First, there is no "weather" up there. The air is dry, storms are unknown. With the same energy, a plane can double its sea level speed at 40,000 feet. This saves half of the time required for the same operation at a low level, and is one of the economic reasons why substratosphere flying is here to stay. Also, the flier whose ceiling is virtually unlimited can select an altitude where tail winds are most favorable. The velocity of the wind generally increases with the altitude.

The postwar substratosphere traveler will be able to pick up a magazine and relax when he climbs into the fat round fuselage of the Los Angeles-London Limited. (It will be built round instead of oval to meet requirements of the pressure cabin.) He won't be worried about anoxia, or the bends, or the whereabouts of his bail-out bottle. His only worry will be whether he can make that date in London.

Names and addresses of makers or sellers of commercial products described in this magazine are listed in the Where-to-Buy-It index. Write to them for additional information and be sure to Say You Saw It in Popular Mechanics.



# Who can use this after the war?



SO far this is definitely a war baby. It was born to meet an exacting wartime need. Every one that is made goes right into the fight.

It is an electric motor designed for jobs which no regular electric motor could fill.

The jobs are on America's fighting planes. Working control flaps—opening and closing cooling shutters—lifting landing gears—and the like.

Every ounce on an airplane is precious. So usual electric motors were out.

This one weighs as little as 8-tenths of a pound—others can move as much as 35 tons.

Naturally it took a whole new

kind of engineering to make this motor.

It took new ideas from the drawing board up. It took new materials—like glass-insulated wire—to build it. It required finer, more precise craftsmanship than had ever gone into a motor before.

After the war, these motors can be sold to manufacturers of peacetime products.

That is why we are telling you about them now.

You may have need for such a compact, ultra-efficient source of power. You may be able to use the kind of engineering thinking that developed it—or the production technique that builds it and about 250 other Lear Products.

PLANTS: Piqua, O., and Grand Rapids, Mich. BRANCHES AT:  
New York, Los Angeles, Chicago, Detroit, Cleveland, Providence.





# WORKERS! WHO SUFFER 'FACTORY' ITCH SKIN RASHES

**Famous  
Liquid  
Promptly  
Relieves  
Torture!**



First applications of wonderful soothing, highly medicated *liquid Zemo*—a Doctor's formula—promptly relieve intense itch and burning of simple skin rashes, Eczema, Psoriasis, blemishes and similar skin and scalp irritations due to external cause. Zemo also aids healing. Amazingly successful for over 35 years!

'Clean, stainless—invisible Zemo won't show on skin—First trial convinces! Keep a bottle at your work, too. 3 sizes. Buy Extra Strength Zemo for stubborn cases.'

## ZEMO

### BATTLE TESTED

*For YOUR Car*

• Wartime research, engineering and actual use in battle areas, assure you an improved HULL AUTO COMPASS for post-war driving. Remember the name—HULL.

HULL MFG. CO., P. O. Box 246-D2  
Warren, Ohio



BUY BONDS  
Assure  
Democracy's Future

### CRAFTSMEN—STOP RUST WITH

## FIENDOIL

Protect tools, clean and coat them with this anti-corrosive favored for years by gun and tackle users. Get it now at your Sports or Hardware Store.

2 oz. Bottle—35¢

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We'll save you money on everything. Largest and most complete trailer builders' supply house in the United States. Member TRAILER COACH MFRS. ASSOC. Send 10¢ for parts catalog.

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719 N. Seventh St., Milwaukee 3, Wis.

Complete Plans and Building Instructions, 50¢

## ★★ TIE FLIES

### NEW, EASY WAY!

**FREE VISE!** New larger 1943 Fly-Tying Kit, complete with Vise. First set, of dyed and natural Fur, Hackles, Quills, Wing Materials, Thread, Pins, Flops, Impale Tails, Cement, Wax, Fly Body Materials, Hooks, etc. Simple step-by-step instructions easily followed. Pay postman, only few cents postage. (If you prefer) sent \$1.00 bill, check or money order and we pay postage. Satisfaction guaranteed or Money Back. Free Catalog.

TACK-L-TYERS,

Dept. 502,

EVANSTON, ILL.

\$12.00  
VALUE  
NOW ONLY  
\$1

## "Off Again-On Again" Railroad

(Continued from page 5)

on "green" track for a year or more until it has "settled," auto-railer operation is feasible immediately after the road is built.

Such a railroad utilizing wooden tracks, floating bridges, and wooden trestles, connecting existing railroads and highways, when practicable, can be built for only a small fraction of the cost of a steam railroad. Its locomotives and other equipment cost much less than a steam train. Yet, the rubber tires will offer such traction that the auto-railer locomotive can pull much heavier loads in proportion to its weight than can the steam locomotive.

No military railroad has been built in Alaska because of the lack of steel rail, steel for locomotives and for cars, and because of the difficulties of construction. The auto-railer will require no steel rail though it will need a steel angle iron on the inside of the wooden rails as a bearing for the steel pilot wheels. Its freight cars will be built of plywood without making impossible demands on our steel supply.

The Federal Government has charted three routes upon which could be built highways or railroads into Alaska. All three of these routes could ultimately be used for auto-railer railroads forming a network of cross lines tapping the various resources of Alaska and running into Canada and the United States. These could be built at a minimum of cost.

The Arctic will be a new frontier to absorb the restless energies of millions of men released from the urgencies and wastes of war. It will be a major military and air establishment for the United States commanding the North Pacific. It will be a way station to Russia. It can be a teeming hive for industry and commerce.

Alaska, the gateway of the world, will offer opportunities such as inspired our fathers in 1849. With a great growth in air transport, hundreds of airplanes will leave Alaska every day loaded with merchandise and passengers for all parts of the Northern world. We must have railroads to supply these airplanes en route, and at their termini in Alaska, and to supply the raw materials that will be fabricated there in factories for foreign consumption.

Once more our horizons will be lifted and our frontiers advanced. Opportunity such as we never dreamt of during the past fifty years once more knocks on our door. To our boys being beckoned by opportunities for the development of Australia and China, we can also say: "Go northwest, young man! Go Pacific Northwest!"



# Ingenious New Technical Methods

Presented in the hope that they will  
prove interesting and useful to you.

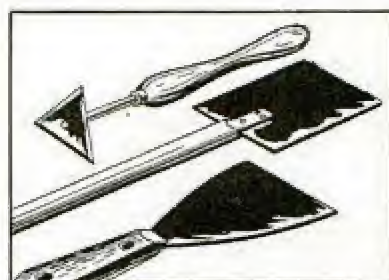


## Beryllium Copper Bites Into Steel

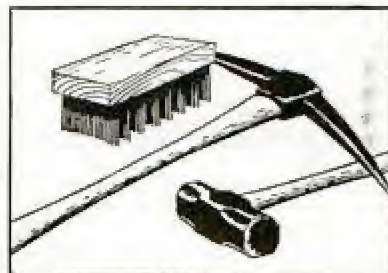
It is an old saying that when a dog bites a man it is not news, but when a man bites a dog it is news. That being the case, it is certainly news when copper bites into steel. Copper is, of course, one of the softer metals but when 2 per cent beryllium is added to copper, its characteristics are changed. The alloy is heat treatable which explains the remarkable strength and hardness. Hit a chisel made of Beryllium Copper with a hammer and it will bite into steel without dulling the edge. Tools made of Beryllium Copper are non-sparking and therefore are used in ordnance plants, oil refineries and other places where explosions may occur from sparks off steel tools. Tensile strength as high as 200,000 lbs. psi can be obtained with Beryllium Copper; hence, it is used for many applications where resistance to high loading and impact fatigue are important, such as airplane motor bushings. Most of the critical springs and diaphragms used in aviation, Navy and Signal Corps instruments are made of Beryllium Copper because of its reliability as a spring material.

We hope this has proved interesting and useful to you just as Wrigley's Spearmint Gum is proving useful to millions of people working everywhere for victory.

*You can get complete information  
about these tools from the Beryllium  
Corporation, Reading, Pennsylvania.*



Man has tried for ages to rediscover the art of hardening copper. Today this can be done by adding to copper a small percentage of beryllium.



Not only does it produce an alloy harder than tempered steel, but one that does not produce sparks, an essential when working near highly combustible materials.

X-67



# POWDERED METAL *helps* ... *and* SPEEDS



**FROM POWDER  
TO GUN PART IN**  
*22 Seconds!*  
**( 200 TIMES FASTER )**

From metal powder so fluffy that a good puff of breath will blow it away, Chrysler Corporation is today turning out parts of most intricate shapes to precise measurements. Some of them are actually so tough that they will even cut glass.

Back in the late twenties Chrysler Corporation Engineers developed and its Amplex Division began to produce heavy duty oil-cushioned bronze bearings. The experience gained in this interesting and economical way of manufacturing is now saving precious time, strategic metals and releasing machine tools and men for other war work.

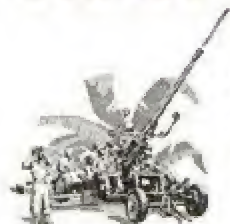
Chrysler Corporation produces hundreds of thousands of powdered metal parts every month for the Nation's superior weapons of war.

WAR BONDS ARE YOUR  
PERSONAL INVESTMENT  
IN VICTORY

**CHRYSLER**  
AMPLEX • PLYMOUTH • DODGE



# *build* SUPERIOR WEAPONS WAR PRODUCTION



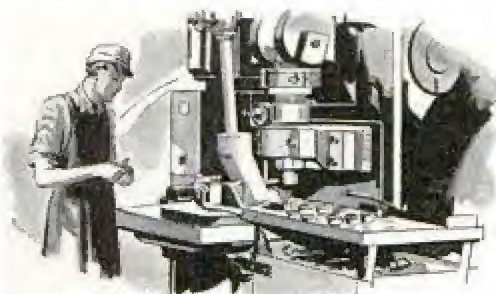
## Powdered Metal Parts Save Both Metal and Man Hours

This anti-aircraft cannon uses 106 different, solid or oil-impregnated parts made from powdered metal. Over a 12-month period, the use of powdered metal parts on this weapon instead of originally designed solid metal parts, alone released 8,000,000 man hours and 1,250,000 pounds of metal for other war tasks. As an example of metal saving, a 20-pound part requires only 20 pounds of powdered metal; whereas, in standard manufacturing practice, losses in machining sometimes range from 20 to 75 per cent.



## Oilite Solves Many Lubrication Problems

Self-lubricating Oilite bearings in engines and controls, help fast climbing aircraft get "upstairs" in a hurry. Functional problems caused by quick and extreme temperature changes from ground level to high altitudes are often solved through the use of countless Oilite bearings which are practically "fool-proof" in operation. Some bombers contain more than 2,000 powdered metal parts made by Chrysler Corporation.



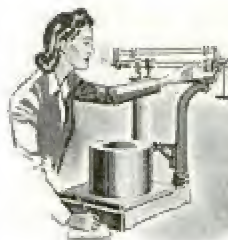
## New and Fine Degrees of Precision are now Attained

Chrysler Corporation produces, in quantity, micrometer frames, tool makers' vee blocks harder than glass, gauge units and other instruments capable of accuracy greater than one ten-thousandths (0.0001") of an inch.

Making such precision instruments was formerly a slow, painstaking task. Now they are "pressed out" in a matter of seconds, 75 per cent complete.

## Big Parts Developed for War Machines

Engineers, metallurgists and powdered metal production men of Chrysler Corporation have definitely disproved the belief that some large and heavy parts could not be made from powdered metal.



Where a part weighing three pounds was a pre-war maximum, Oilite bearings twenty times this size are now being made.

## From Peacetime Research Have Come Developments that Solve Many War Production Problems

Remember the days when you could first forget about oiling the vacuum cleaner or refrigerator or the clutch bearings on your automobile? This was only the starting phase of great development in the field of powdered metal manufacturing. In its production of many thousands of different war weapon parts, Chrysler Corporation, a pioneer of *heavy duty* and *large* powdered metal units, has brought a fast, economical metal-and-manpower-saving means of manufacture to major war industries.

Tune in Major Bowes every Thursday, CBS, 9 P. M., E. W. T.

# CORPORATION

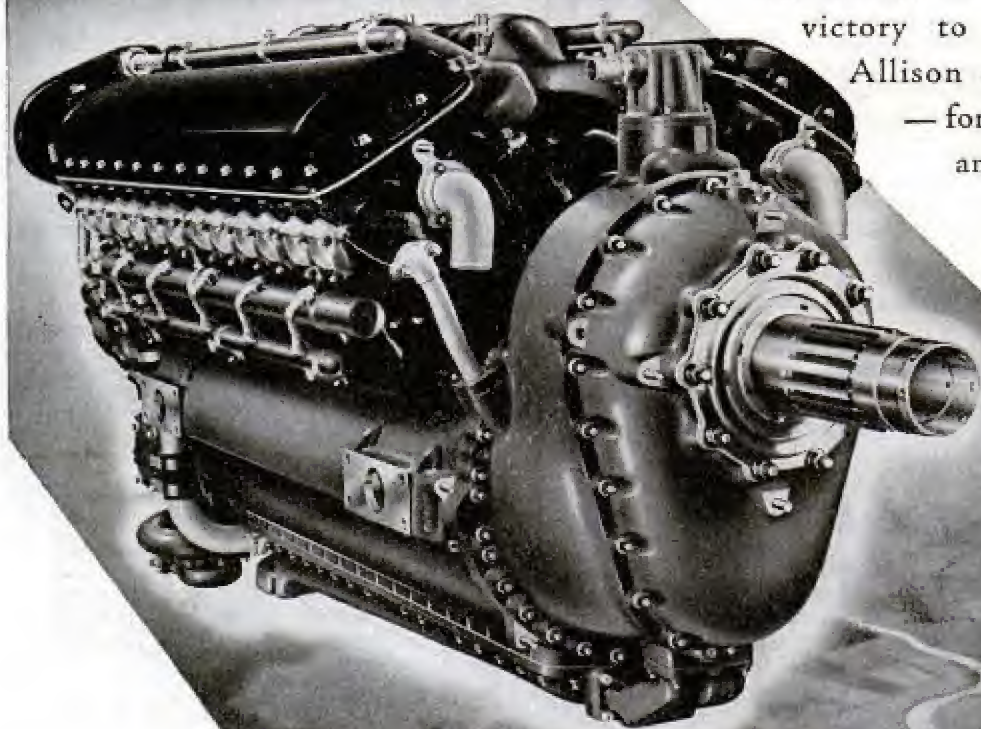
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# THE ENGINE THAT IS ALWAYS THERE

Allison-powered planes have been called upon in every major engagement in which our Army has taken part. ★ They have had a hand in every great land victory to our credit. ★

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LIQUID-COOLED AIRCRAFT ENGINES

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KEEP AMERICA STRONG  
BUY MORE WAR BONDS





## WHY DO WE SAY "ELASTIC"?

This is an Elastic Stop Nut. You know it by the red collar. That collar is plastic—and elastic.

This is why the Elastic Stop Nut is different from other nuts.

When this nut is put on, the bolt threads press into the collar. It more than fits—it squeezes.

The nut can't wiggle, turn and loosen. It locks and holds tight—anywhere on the bolt.

Being elastic, the collar "comes back" after the bolt is removed. So Elastic Stop Nuts can be used over and over again and still lock.

Billions of Elastic Stop Nuts are being made today. And to our knowledge, not one in a million has ever failed.

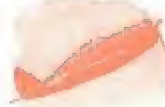
After the war these self-locking nuts will make hundreds of things you buy safer, stronger, more durable. So watch for that distinctive red collar—it's the mark of these unusual self-locking nuts made by Esna.

**ESNA**  
TRADE MARK OF  
ELASTIC STOP NUT CORPORATION  
OF AMERICA

**ELASTIC STOP NUTS**  
*Lock fast to make things last*  
Union, New Jersey and Lincoln, Nebraska



## WHERE ELASTIC STOP NUTS ARE GOING NOW



There are more Elastic Stop Nuts on America's planes, tanks and naval vessels than all other lock nuts combined. More than 12,000 of them go on the P-47 Thunderbolt. Two important applications show in the picture above.

1. Just four Elastic Stop Nuts fasten the fittings that hold each wing.
2. Just four bolts held secure with Elastic Stop Nuts fasten the throbbing 2000-hp. Pratt & Whitney engine onto the ship.



# KEEP OLD LAWNMOWERS CUTTING with the IDEAL LAWNMOWER SHARPENER

## PERFORM A REAL SERVICE

Keep lawnmowers in service on the home front! Old lawnmowers, like other household equipment, must continue to last so that vital materials can keep flowing to our armed forces. You can keep 'em sharp . . . make old, dull lawnmowers cut like new, and make money too, with the Ideal Lawnmower Sharpener.

Easy to operate, no experience necessary—just set the mower in the sharpener, make a few simple adjustments, the machine does the rest. Sharpens like magic to perfect edge in just a few minutes. Write today for complete details.



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1244 Bell Street, Plymouth, Ohio

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- ★ EASY TO OPERATE
- ★ KEEN EDGE IN 20 MINUTES



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### BETWEEN YOU and THE COLD

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### EASY TO APPLY

Unrolls like ribbon. Just press into place and it stays put. Does not crack, chip, dry out or shrink.

About 80 ft. to a roll. At stores, or \$1.25 prepaid (\$1.40 west of Rockies).

Send for Circular



### STOPS THAT DRIP

A sure cure for condensation drip from tanks, pipes, walls, ceilings, etc. Apply with brush, trowel or spray. At stores or \$1.90 for 1 gal. prepaid (\$2.10 west of Rockies).

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	V	V-2	V-3
Hex	1/2"	3/4"	5/8"
Thread	3/8"-24	1/4"-32	1/4"-32
Thread Length	3/8"	3/32"	3/32"
Weight, Grams	8	3 1/2	2 1/2

Actual Size V-Plug

Champion spark plugs for model gas engines give the same dependable performance as their larger counterparts. Silliment sealed. Sillimanite insulator. Alloy needlepoint electrodes for easy starting. One-piece construction.

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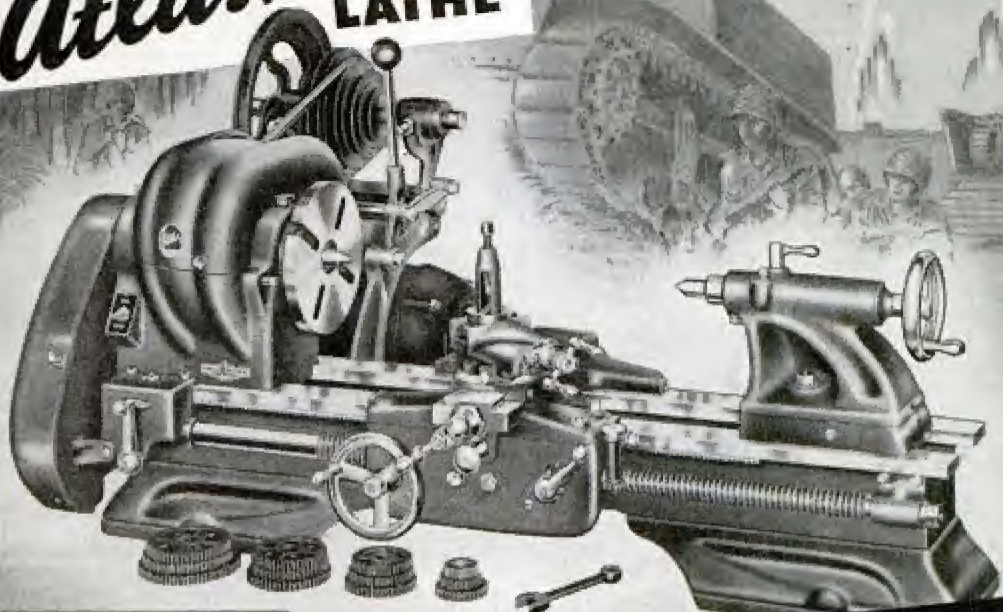
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POPULAR MECHANICS



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## F-Series 10" LATHE



### CONDENSED SPECIFICATIONS

Swing Over Bed	10 1/4"	Thread Cutting	
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16 Spindle		Four Bed	
Speeds	28 to 2073 RPM	Lengths	18" to 36" centers.

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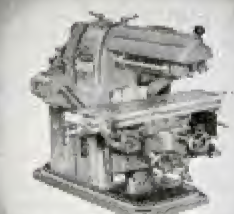
The Atlas Lathe is one of the best known of the Atlas machines behind the guns. It's a favorite in production centers and in mobile machine shop of our armed forces. Compact, rugged, accurate, it has turned out millions of the parts that make up our tanks, ships, guns, and planes.

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AFTER THE WAR

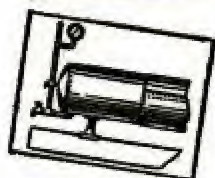
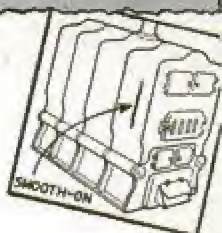


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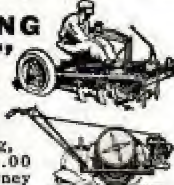


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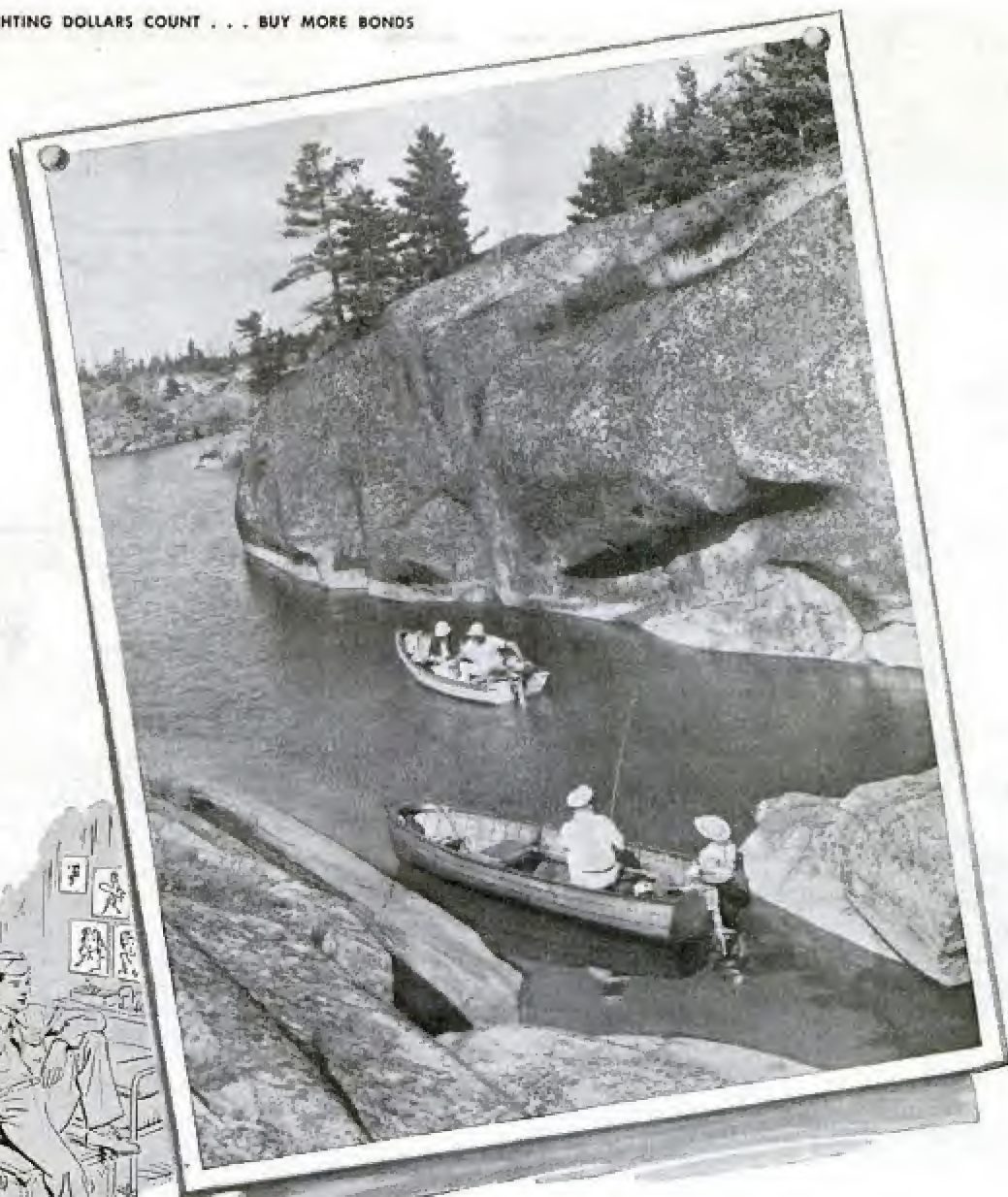
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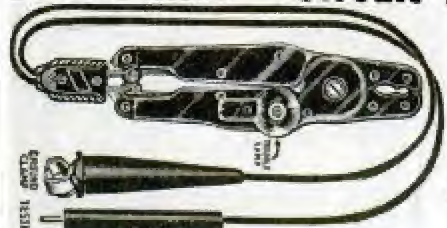
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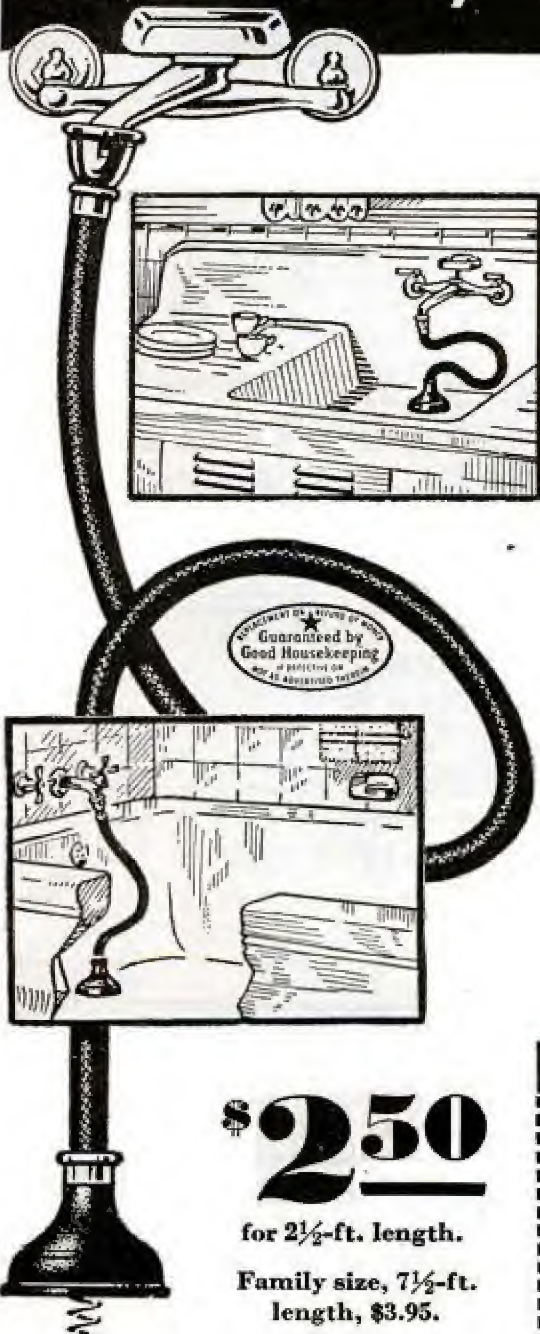
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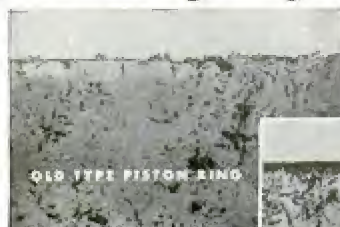
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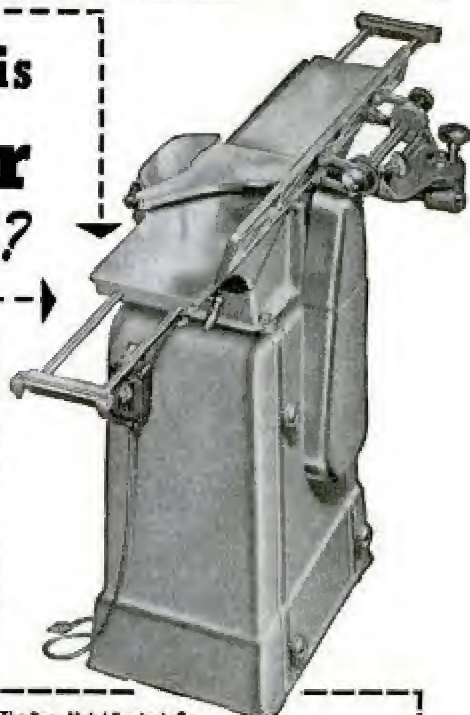
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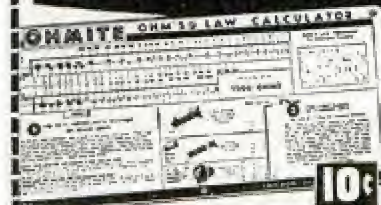
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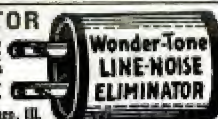
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